the OIL AND GAS JOURNAL
PUBLISHED WEEKLY FEBRUARY 22, 1960

EDITORIAL

Oil Is Acquitted—But the Government Now Stands Indicted ▸ 56

Lessons learned from the Tulsa case ▸ 61

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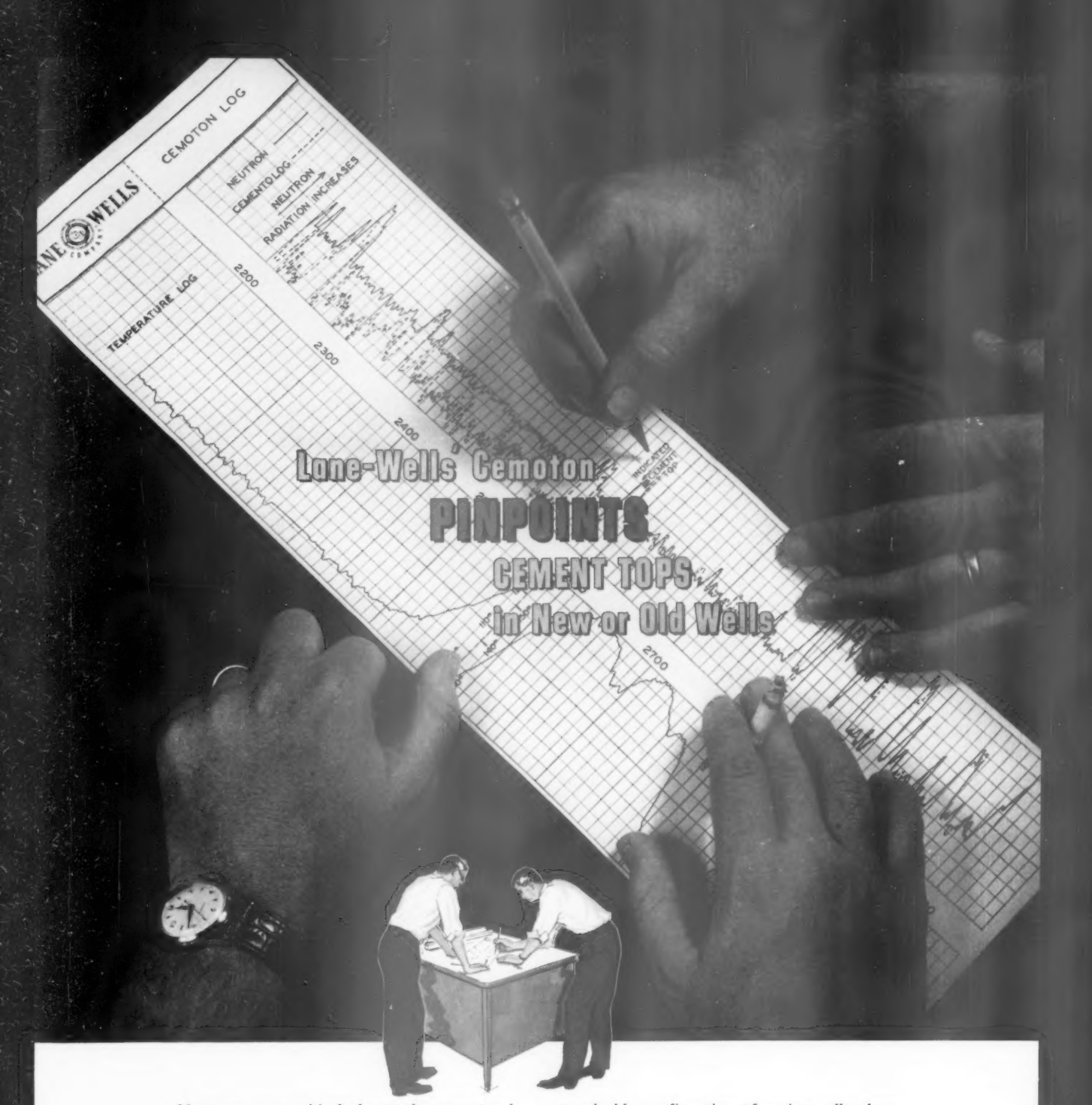
CO_2 drops reservoir-oil viscosity ▸ 96

Furfural increases cat cracker gasoline ▸ 120

Earth Scientists Planning Drastic Reorganization

OBJECT: To raise professional standards, and to provide for self-regulation. ▸ 68



Now you can positively locate the cement column and cement top . . . even in old wells. Lane-Wells' Cemoton Log is an exclusive method for obtaining accurate indications of cement tops, and, since it is not dependent upon thermal changes, it can be applied to wells of any age. The log is usually made in conjunction with other surveys using cased-hole equipment so that no extra rig time is required. It provides a valuable confirmation of casing collar locations and also indicates uncemented sections below the cement top. Easier to interpret, more accurate than a temperature log, and very economical when run with neutron or gamma ray-neutron surveys. It will pay you to check with your Lane-Wells man and get the Cemoton story firsthand. Ask to see sample logs or write direct for additional information.

LANE-WELLS COMPANY

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OIL AND GAS JOURNAL
Vol. 58 No. 8

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Annual index available on request.

TECHNOLOGY—OPERATION

Production

Mene Grande Generates Own Power 91

By C. M. Honaker and D. F. Bruce

Exploration, production, and transportation requirements are satisfied by this $12,000,000 plant. Completely isolated, it does not interconnect with other power plants, and no power is bought or sold. Small alternate sources are located in pipeline pumping stations for standby use.

CO_2 Reduces Viscosity of Heavy Oil 96

By L. R. Dickerson and G. W. Crawford

Laboratory tests show that production of viscous crude may be made more efficient by injection of certain gases which have a marked effect on crude viscosity and density. Comparison of the various gases which have been studied at different concentrations and temperatures shows that carbon dioxide is most effective at normal reservoir temperatures of 125° F. and above.

Reservoir Engineering—No. 20 104

By E. T. Guerrero and F. M. Stewart

How to obtain and compare k_w/k_o curves from steady-state and laboratory unsteady-state flow measurements. Calculations show the procedures involved.

Refining-Processing

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Review quiz on the principles of pressure and some A, B, C's of fluid flow.

Control Computer Shows High Service Factor 102

A 6-month test at Sterlington station of Louisiana Power & Light Co. shows the computer service factor to be 99.76%.

Process Costimating—No. 66 103

How number of employes relates to size of company.

How Furfural Extraction Upgrades Cat Cracker Gasoline 120

By R. R. Dickinson and C. B. Longsworth

Units have been in operation for several years at two Texaco refineries and are helping to increase gasoline production at each refinery. These operations show that furfural refining will: (1) Minimize fuel-oil production by making severe visbreaking, coking, or deasphalting practical; (2) reject undesirable components of heavy coker gas oils and low-gravity deasphalted oils; and (3) give superior yield distribution from refined oils.

Pipelining

Use Nitrous Oxide to Spot Pipeline Leaks 100

By John E. Kaufman

Laboratory tests demonstrate feasibility of this tracer gas in hydrostatic testing of underground lines. But work needs yet to be done to develop a suitable technique. As little as 2 p.p.m. of nitrous oxide at the surface of the ground can be detected by an infrared analyzer.

Drilling

Drilling the 50,000-Ft. Well 111

A panel of authorities agrees it could be drilled now, with some changes in present-day equipment and methods. Servicing the well, and producing it, seems to be almost out of the question unless new materials can be made available. Further, if the well produced heavy oil, difficulties would be encountered.

The OIL AND GAS JOURNAL Newsletter

Tulsa, Okla.
Feb. 22, 1960

Rotary rig activity so far in '60 is off about 9%:

The 7-week average of active rigs this year is 1,682 compared with 1,846 for the same weeks in 1959.
The decrease is 184 rigs or 8.9%.

Weekly count of rigs by Hughes Tool Co. last year showed a steady climb after reaching a low of 1,781 rigs for the first week of February. The total was back to 2,000 rigs before the end of March.
Low point this year was January 18 when U. S. total dropped to 1,617 rigs. A 2-week gain period raised the total to 1,710 on February 1. But practically all of this gain has been wiped out in the last 2 weeks. The total was back down to 1,618 in mid-February.

Don't conclude too quickly from this drop that operators have changed drilling plans for the year.
The Journal's survey at first of the year showed scheduled drilling for the year at about the 1959 level.
Producer income from oil and gas will be the dominant factor in the final drilling program for the year.

▼ ▼ ▼

The oil industry's decisive victory in the Tulsa antitrust case provided some legal landmarks and pratcical lessons for oil men.
Lawyers believe the case:
...Provided new way to handle protracted litigation.
...Halted further extensions by Government of the scope of the present antitrust law.
...Showed absolute frailty of trial by innuendo.
...Provided good ruling on question of conspiracy among family group of companies.
Case also revealed to oil men some new ways to conduct their business more circumspectly and may have political reverberations in this election year (p. 61).*

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*Refers to article in this issue giving more details. Where no page is given, the item is a Newsletter exclusive.

Heating oil prices are off again on the Gulf, the second reduction in less than a month.

Low quotation for cargo lots of No. 2 fuel is 8 cents a gallon. The price was 8⅝ cents the last 3 weeks in January and dropped to 8⅜ cents early in February.

Current price is lowest for this time of year since 1953. Summer months have provided some lower quotations but not the heating season.

Kerosine prices also are off—to 9 cents—but they are in better demand because of use in jet fuel. This has restored kerosine to its old position 1-cent higher than No. 2.

Compared to last year, kerosine is 1⅝ cents off and No. 2 is 1 6/8 off. Two reasons for the soft prices: Warmer-than-normal weather this winter and excessive refinery runs.

▼ ▼ ▼

Stepped-up gas exploration is needed if industry is to meet demand in years to come.

Petroleum engineers heard W. B. Golush of Shell advise that efforts must be concentrated on provinces more likely to produce gas than crude.

Possible areas: Appalachians, Anadarko, Delaware, McAlester, Val Verde, and Sacramento basins.

If demand rate is to be met, industry must find 26 trillion feet of gas per year, a goal never reached in any year.

Reorganization of world's earth scientists into a new society with authority to enforce high professional standards is under way.

A committee of 80 scientists has the job of setting up the new organization to replace the American Geological Institute and enlisting support of the 30,000 members of other scientific organizations (p. 68).

Teapot Dome field development will be continued by the U. S. Navy, which has asked for bids on 10 new wells in the Natrona County, Wyo., area.

Time limit for completing the drilling program has not yet been announced.

A code of ethics sets down ground rules for friendly cooperation between land owners and oil or gas operators in New Mexico.

Booklet is issued by New Mexico Oil & Gas Association, Santa Fe, and has been an instantaneous best seller. The work is a joint effort of the association and the U. S. Bureau of Land Management.

▼ ▼ ▼

Proration of offshore production by the federal Government is getting serious study.

A federal and Louisiana official will confer March 3 in the first joint discussion on the subject. Talks will be strictly preliminary. The Government is now formulating rules for offshore operations against the day it may decide to assume this conservation role (p. 64).

Major oil companies are playing their cards close in the high-stakes game for new Louisiana offshore acreage.

Bids are expected to be high at the New Orleans sale February 24.

Most of the 288 tracts, comprising 1,608,000 acres, are in wildcat territory seaward from present production.

But the industry has faith that tremendous reserves are there, and companies are gambling that the high prices paid can be justified over the long haul.

Smaller outfits also will ante up for some of the choice leases. A number of combines are reported forming to get up enough bonus money for the game.

Another interesting lease sale scheduled February 24 may offer some real bargains in the far north.

Bids will be taken on 16 parcels of federal lands known as the "buffer zone" adjoining Naval Petroleum Reserve No. 4 on Alaska's Arctic Slope. All the land is believed to lie on the Gubik gas anticline (p. 149).

▼ ▼ ▼

Humble, which moved into Arizona last year, is now definitely planning to expand into California marketing.

It is shopping around for retail outlets and reportedly has looked at the Hanes chain of stations.

Any Humble move into California will be a giant step toward making Jersey Standard a nationwide marketer. In California, however, Humble will be entering one of the hottest retail battles now being staged in the country.

New service-station construction trend may follow Canada's first prefabricated steel station.

The portable station has plumbing, wiring, and other equipment built in. After construction, it is divided in half and loaded on two flat cars for moving to site. There the halves are bolted together.

Service-station sales reached $16.7 billion last year, a 6.4% gain over the $15.8 billion recorded in 1958. Figures come from preliminary report of Bureau of Census.

Travel facts from Bureau of Public Roads:

Motor-vehicle travel in 1958 totaled 664.7 billion vehicle miles, up 2.7% over 1957, and in 1959 totaled 696 billion vehicle miles.

Average passenger car traveled 9,494 miles in 1958, up 1.1% over 1957, and consumed 664 gal. of fuel compared with 652 gal. in 1957. The car averaged 14.30 mpg. in 1958 and 14.30 mpg. in 1957. Fuel consumption of buses and trucks remained virtually unchanged in the 2 years.

▼ ▼ ▼

France's big government oil agency, Bureau de Recherches de Petrole, may pull out of plans for a big national French oil company to market Saharan oil.

This would calm opposition to original plans for the company, Societe Industrielle des Petroles. Antoine Pinay left the DeGaulle cabinet because he opposed S.I.P. as socialistic. His successor is studying a plan to form the marketing company around France's big privately controlled oil company, Cie. Francaise de Petrole.

Iraq's key oil office has changed hands.

Sayed Ibrahim Kubbah, left wing socialist minister of agrarian reform and petroleum affairs, was relieved of his duties suddenly last week. Replacing him was Talatt Shibani, former minister of planning in the Kassim cabinet.

Kubbah, who follows the Marxist line closely in his political thinking, has been Iraq's chief negotiator in talks with Iraq Petroleum Co. since the revolution put Kassim in power in the country. No reason was given for his dismissal.

Just for the record:

Mexican President Adolphe Lopez Mateos has been widely quoted in the Latin American press as saying during his trip to Caracas that "the present sound economic situation of my country can be attributed to the nationalization of the oil industry 20 years ago."

What many accounts omitted is that President Mateos then said nationalization is not necessarily the best policy for all oil countries.

He commented that he didn't think it would be good for Venezuela "because it has been obtaining excellent profits from its oil."

The Washington beat:

Speculation is beginning to stir over whether William R. Connole will be reappointed to the Federal Power Commission and whether Robert A. Bicks will be appointed as assistant attorney general to head the Justice Department's antitrust division.

The coal research bill, already passed by the House, has a good chance in the Senate. It will call for an expenditure of $2 million on coal research by the Interior Department. If that bill passes, the coal industry will renew efforts for a national fuel policy study by a congressional committee.

Good Wells Make Good News

Engineered Fracturing Treatments That Increased Operators' Profits

February 22, 1960

The "Frac Guide"* has helped make fracturing more useful than ever before. Here are recent treatments that increased net profits to producers.

- **Wayne County, Illinois** (New Oil Well) A well was completed into the Aux Vases through perforations from 3220 to 3230 feet. Usual practice has been to fracture these wells with one pound 20/40-mesh sand per gallon of fluid. Dowell engineered this treatment with the "Frac Guide": 12,000 gallons gelled crude carrying 20,000 pounds 20/40-mesh sand plus 3000 pounds 10/20-mesh sand. Injection rate was to be 30 bpm and estimated fracture area was 26,000 square feet. Treatment was performed according to recommendations. Before fracturing, well made only a show of oil. After return of load oil, it tested 10 boph.

- **Barber County, Kansas** (Old Oil Well) Completion was open hole into the Mississippi Chat. After the well was deepened to 4612 feet, but before fracturing, the 83-foot open hole section produced 4 to 7 bopd. A fracturing treatment followed recommendations prepared with the "Frac Guide". Treatment was down annulus between 2" tubing and 5½" casing. Frac fluid was 40,000 gallons of water with fluid loss, silicate control and surface tension-reducing agents. 40,000 pounds of sand was used. Injection rate averaged about 35 bpm at 2100 psi maximum pressure. A 200-pound salt plug was used midway in the treatment. The well cleaned up without swabbing and leveled off at 40 bopd flowing.

- **Marion County, East Texas** (Old Oil Well) In 23 months, production had declined from 40 to 13 bopd. Original completion was through perforations into the Henderson formation from 5911 to 5921 feet. Dowell recommended Petrojel*. Well was fractured down tubing at 4.7 bpm and 5400 psi maximum. 12,000 gallons of gelled crude carried 6000 pounds sand. Sand was shut off for two minutes out of every six to reduce danger of blocking perforations. After treatment, production leveled off at 66 bopd — a net increase of 53 bopd.

- **Jefferson County, Oklahoma** (Old Oil Well) Pay zone is the Des Moines sand, and perforations are from 1137 to 1147, 1152 to 1170, and 1364 to 1382 feet. Production had declined to 8 bopd. Well was given a treatment engineered with the "Frac Guide": 15,000 gallons lease oil with F.L.A.* (Fluid Loss Additive) and 30,000 pounds 20/40-mesh sand. 90 ball sealers were used during injection down casing at 26 bpm and 600 psi. After clean-up, well tested 250 bopd — about double the increase normally achieved in this field.

If you want the best possible return per dollar invested in well stimulation, ask Dowell to engineer your frac treatments with the "Frac Guide". For service or detailed information, contact the Dowell office or station nearest you. There are more than 150 locations in the United States, Canada, Venezuela and Argentina. Dowell, Tulsa 1, Oklahoma.

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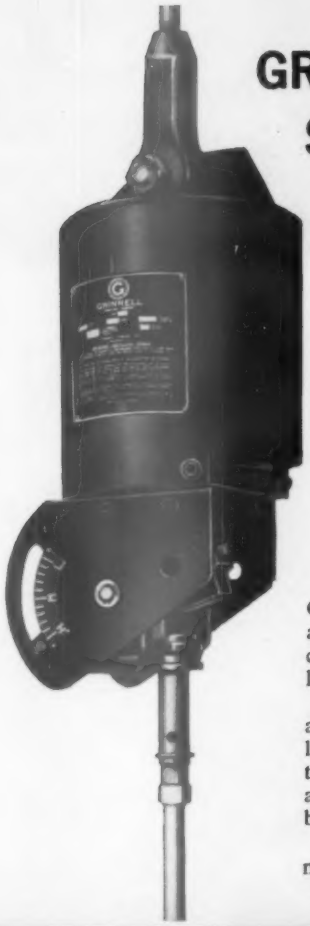

GRINNELL CONSTANT SUPPORTS...

2 BASIC DESIGNS...

11 DIFFERENT METHODS OF ATTACHMENT

Grinnell Constant Supports are available in a range of sizes to provide capacities for loads from 27 lbs. to 57,500 lbs., with travels up to 16 inches.

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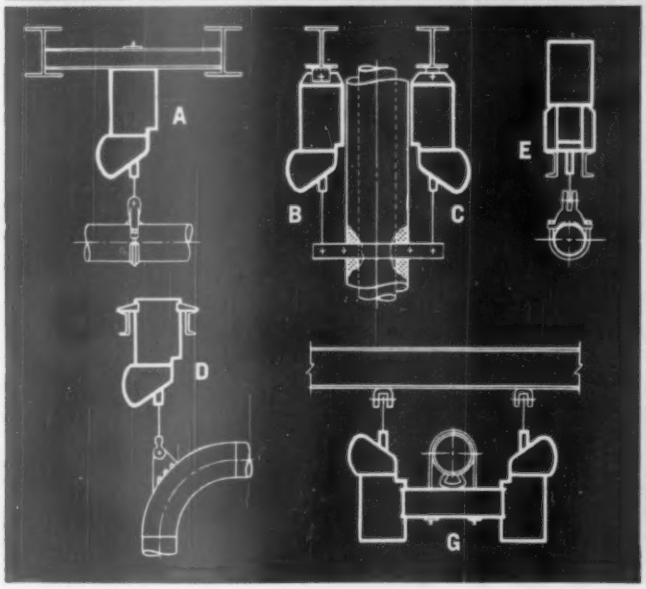
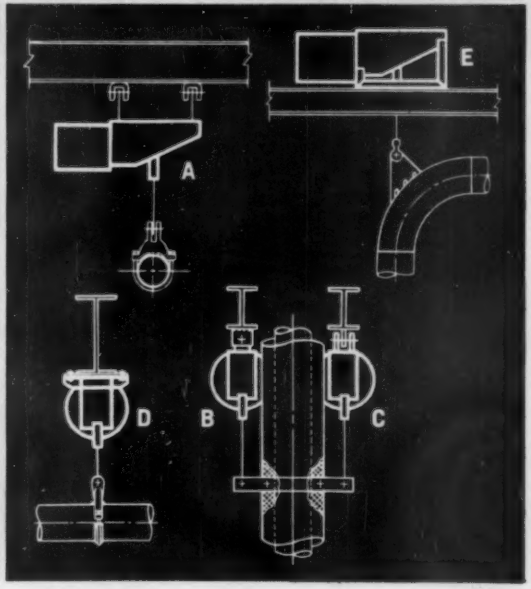
Grinnell Constant Supports provide mathematically perfect load support throughout all positions of travel . . . also a full 70 percentage points of adjustability is built into them. No less than 10% of this adjustability is allowed either side of calibration for plus or minus change in load. Field readjustments are easily made by turning a single load adjustment bolt.

Call on Grinnell's Pipe Suspension Department for help with your pipe suspension problems. Grinnell Company, Providence 1, Rhode Island.

FOR VERTICAL ATTACHMENT



FOR HORIZONTAL ATTACHMENT



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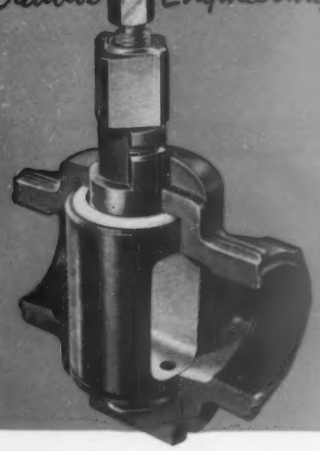

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TUBING SPACER INSTALLATION

TUBING SUPER SEAL FLOAT SHOE

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ADVANCED TUBING FLOATING EQUIPMENT

. . . such as the popular Halliburton Super Seal Float Shoe, has been developed in sizes for tubingless completion work.

AND MANY OTHER TUBING ACCESSORIES

available for tubingless completions include the Halliburton Full-Flow Packer Shoe, Cement Basket, Latch Down Tubing Plug and Adapter, Tubing Guide Nose – and many more items now under development.

Designing and manufacturing new small downhole tools required for tubingless well completion work is just another way in which Halliburton serves you. Ask your local Halliburton Representative for more details on these or other equipment and service you may need.

"DV" MULTIPLE STAGE TUBING CEMENTER

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CEMENTING SERVICES

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"TOOLS AND EQUIPMENT TO MATCH THE JOB"

How **protection in depth** helps cut compensation costs

Improving rig safety from spud-in to completion

Liberty Mutual engineers know rigs. They know how to evaluate blowout preventer procedures and check fire protection planning. They know drilling safety, and they know how to get this all-important story across to your crews. Such knowledge and experience in safe drilling practices can help any pusher or driller reduce accidents and losses — and workmen's compensation costs. This safety engineering is but one of the many Liberty Mutual services that add up to protection in depth. For more facts about Liberty's protection in depth and how it can help lower your business insurance costs, contact your nearest Liberty Mutual office.

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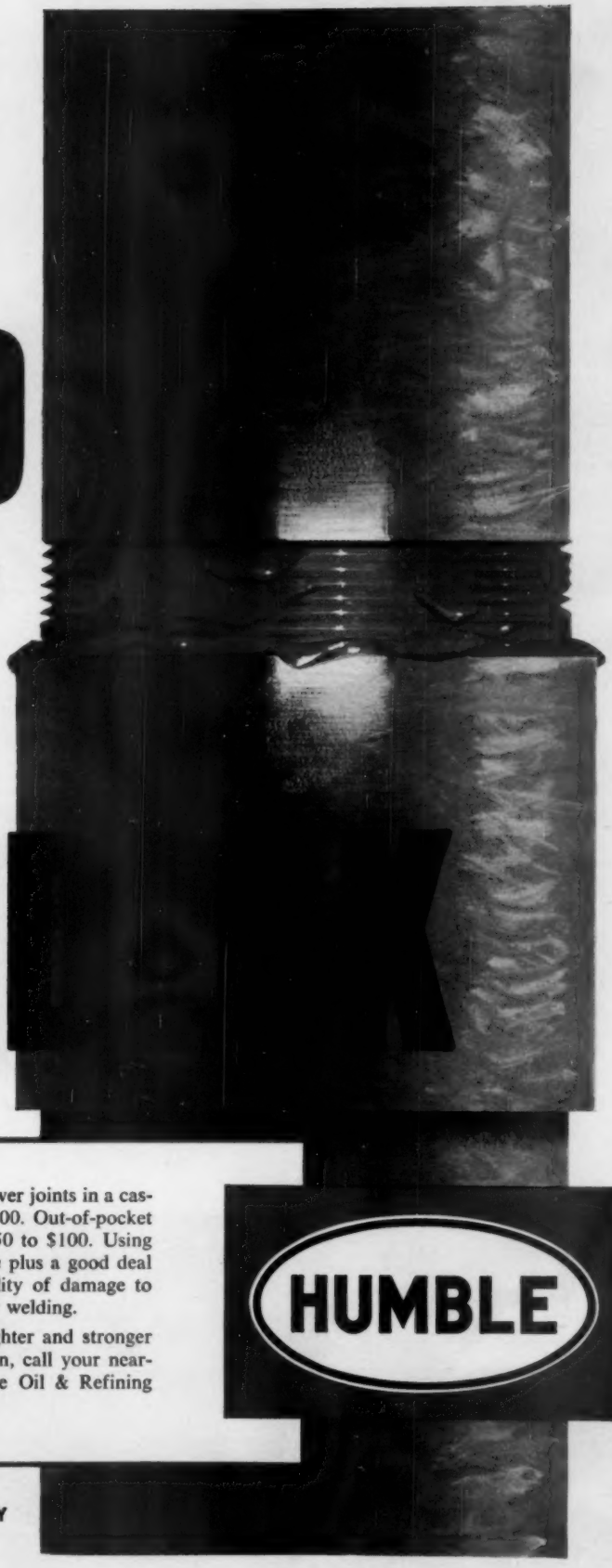
Lock your casing

with THRE K



Your own crew can lock and seal the lower joints in a casing string with THREDLOK for about $10.00. Out-of-pocket costs of welding would be approximately $50 to $100. Using THREDLOK, you can save $40 to $90 *cash* plus a good deal more in time, and you prevent the possibility of damage to high strength casing that could be caused by welding.

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HUMBLE

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Flat carloads of Rockwell Hypresphere valves ready for shipment to a western gas transmission company.

ACCEPTANCE: BY THE TRAINLOAD

The trainload of Rockwell Hypresphere lubricated spherical plug valves (above) is dramatic evidence of the immediate acceptance of this valve by oil and gas pipeline engineers. Introduced just a little over a year ago (after three years of rugged field testing) the Hypresphere has been specified on most of the big, new pipeline jobs. Why?

The Hypresphere gives pipeline engineers all of the advantages of a lubricated plug valve (positive shut-off, easy operation, faster closure and lubricant economy) with a full round port opening. Also, the Hypresphere is far more compact than non-lubricated valves of equivalent size and pressure rating. Why not get full details plus information on the *complete* line of Rockwell-Nordstrom standard and Hypreseal lubricated plug valves. *Write: Rockwell Manufacturing Company, Pittsburgh 8, Pa. Canadian Valve Licensee: Peacock Brothers Limited; Rockwell International, S.A., Geneva, Switzerland.*

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another fine product by

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Rockwell Hypresphere ready for underground installation. Note compact size for 30-inch valve.

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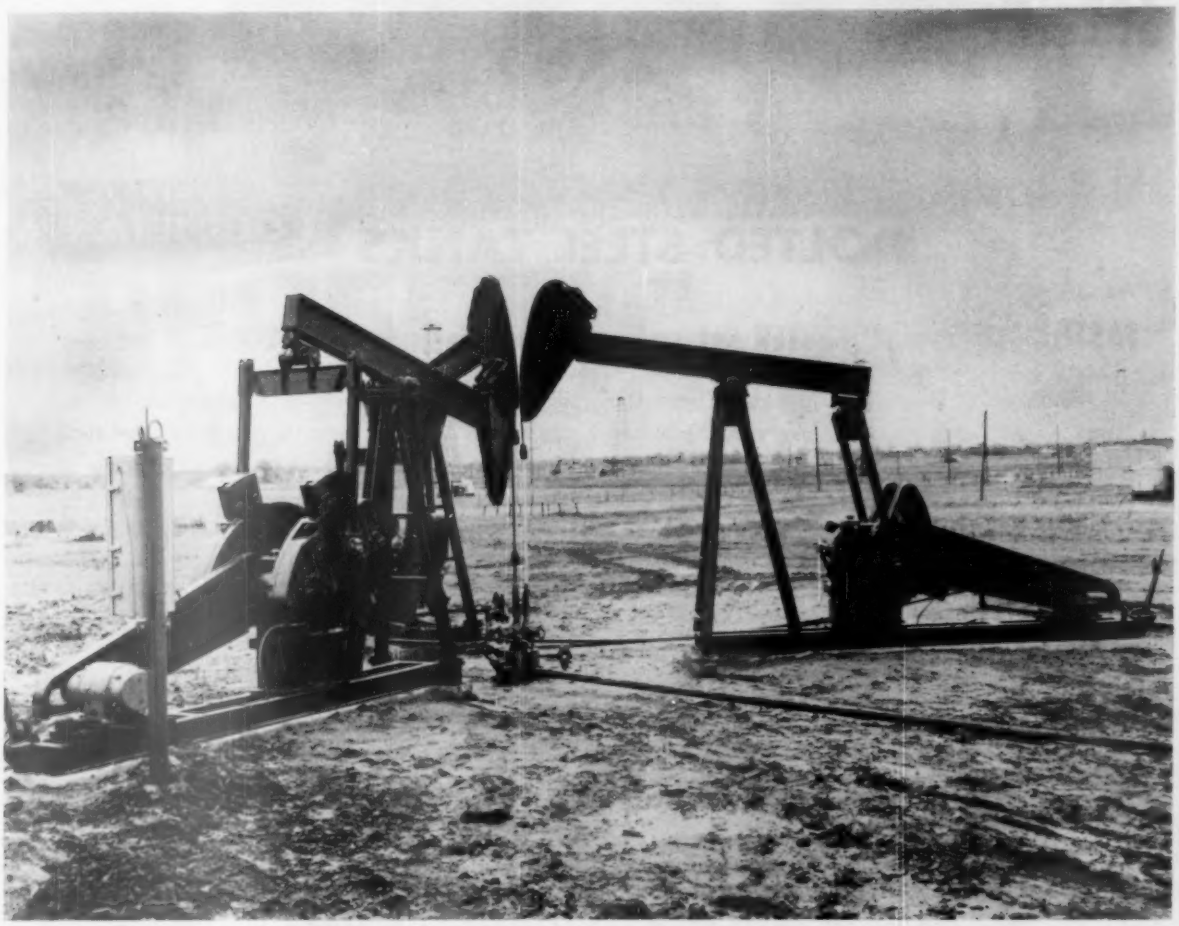
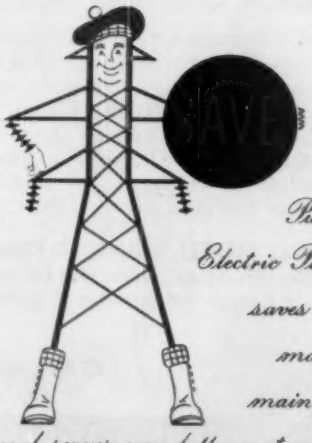
LOW COST PRODUCTION



Three zones being pumped simultaneously from single well with this utility-electric powered triple pumper

Economies of purchased electric power have been proven time and again for producers who have learned to depend on utility service in their fields. Saving in manpower and adaptability for automatic control makes utility electric power ideal not only for production but for gathering, pipeline and refinery operation. See your nearest utility electric power company for details or write the Petroleum Electric Power Association.



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adaptability / strength / speed

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Need a warehouse, field office, storage or tool shed, pump house — immediately? Count your time in DAYS — instead of weeks or months! Count your costs far under what you figured! Look into Columbian RIGID FRAME Steel Buildings — so adaptable, movable, fire-safe, so liberal in providing maximum work or storage space. Designed to allow for easy construction of a wide variety of sizes, styles and arrangements — with speed, strength and economy uppermost! See your Columbian dealer!

KNOW MORE! Write us for FREE Bolted Steel Tank booklet — Steel Building folder. See for yourself why Columbian tanks and buildings are stronger, tighter, longer-lasting.

RUSH DELIVERY AND ERECTION BY CONTACTING YOUR NEAREST COLUMBIAN DISTRIBUTOR

COLORADO
O'Neill Tank Co.
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ODESSA

WYOMING
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GILLETTE

CANADA
C W S Tank Co.
CALGARY, Alta
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TANKS FOR THE WORLD

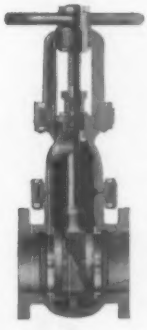
COLUMBIAN STEEL TANK CO.
P.O. Box 4048-J Kansas City, Mo.

STEEL, Master-Crafted by Columbian... First for Lasting Strength

We do contract steel fabrication

HANDLING "PROBLEM" FLUIDS OR GASES?

Specify ALUMINUM GATE VALVES by Darling



Aluminum flanged end gate valve. Also available with other types of ends. Can be furnished with inside screw stationary stem.

Where you're handling highly corrosive materials... or where valve weight is a factor... Darling Aluminum Gate Valves make sound economic sense.

High-corrosion-resistant aluminum alloys... carefully selected and thoroughly tested by Darling metallurgical engineers... are used for structural and pressure-containing parts. They've been *proved-in-use* as the most generally corrosive-resistant aluminum alloys in use today.

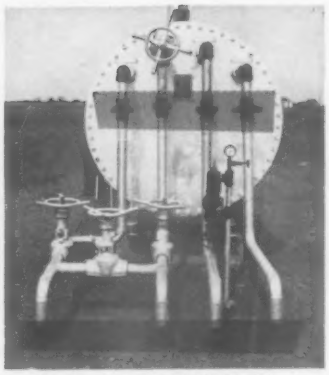
Double disc parallel seat principle assures maximum life under the most exacting service conditions. "No pocket" discs and wedges prevent accumulation of line scale or sludge. Wedge design reduces friction to a minimum, assures positive sealing and ease of operation.

DARLING VALVE & MANUFACTURING CO.

Williamsport 1, Pa.

Manufactured in Canada by Sandilands Valve Manufacturing Co., Ltd., Galt 19, Ont.

WECO Unions on gas cooling coils for repressuring unit



Heater Hook-up with WECO Unions

WECO Unions & Chiksan Joints on fracturing head

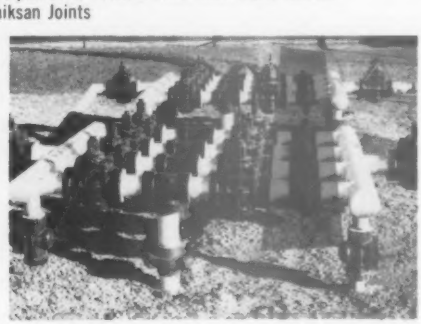
WECO UNIONS
ARE EVERYWHERE IN THE OIL INDUSTRY

On the drilling rig you find them on mud suction and discharge lines . . . on fuel, steam and water lines . . . on stand pipe connections . . . blowout preventer hook-ups. You will find them, too, on service company trucks, lines and head connections in cementing, acidizing and fracturing operations.

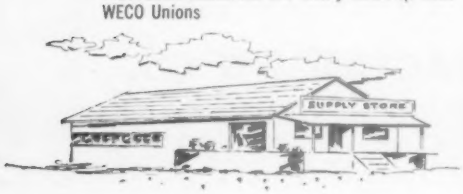
Wherever there is production, WECO Unions are used in making up headers and manifolds; tank, heater, treater and separator installations; on flow lines, meter connections and wherever else unions are used for faster, more efficient piping. You will find them also on offshore rigs, platforms and production hook-ups —on water flooding and repressuring projects.

There is a WECO UNION of the right type, size and pressure rating for every service in every phase of the industry . . . and they are available from stock at Supply Stores everywhere. For the WECO Unions you need—see your WECO catalog, or refer to pages 5105-5124 of your Composite Catalog; call your Supply Store or your WECO representative.

Blowout preventer control lines with WECO Unions and Chiksan Joints



Production manifolds are easily made-up with WECO Unions

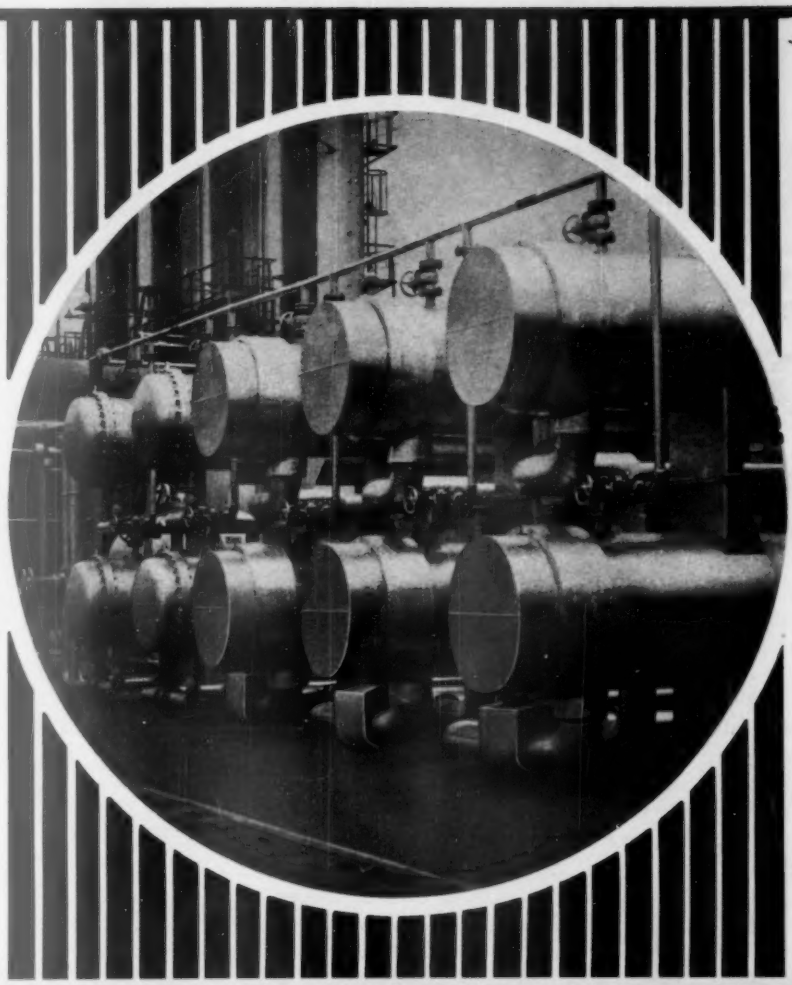


WECO

WELL EQUIPMENT MFG. CORP.
HOUSTON, TEXAS
Division of CHIKSAN COMPANY a subsidiary of FOOD MACHINERY AND CHEMICAL CORPORATION

fmc

U-5-59



HEAT EXCHANGERS BY CHIYODA

Heat exchangers, coolers, condensers and other process equipment, standard or special, large or small, single or by the scores, are fabricated by Chiyoda at Chiyoda's new Kawasaki Factory with the most modern fabricating and testing equipment using fabrication methods backed by years of experience.

With an integrated organization staffed by specialists in every field plus lower man-hour costs, Chiyoda assures clients of early delivery, low maintenance cost, high operating efficiency and long life.

For your process equipment requirements anywhere in the world, CONTACT CHIYODA.

"Process Plants & Equipment Specialists"

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Cable Address: "CHIYOTAKA TOKYO"

MIGHTY... HEALTHY... POWER

Whether your choice is the 225-hp HD-21 or the 150-hp HD-16, you get from 8½% to 27% more efficient engine operation than from other crawlers.

This fuel-pinching efficiency is a fact! Your Allis-Chalmers dealer will show you actual proof of up to 27% fuel savings in the Allis-Chalmers 16000 or 21000 engines over units of comparable size. He'll tell you why they run cleaner . . . how they "sip" fuel to earn the title "industry's healthiest engines."

Six crater-shaped pistons develop 225 hp in the HD-21, 150 hp in the HD-16 . . . both at an easy 1825 rpm. Coupled with torque converter drive, they provide plenty of rough dozing lugability . . . plenty of side boom liftability.

These big Allis-Chalmers tractors are built for mighty tough service . . . right-of-way pioneering, stringing, cradling, or lowering-in. Shock-absorbing all-steel main frame, durable double-reduction final drives, certified permanent lubrication of tapered roller bearing truck wheels, idlers and rollers, and extra tough track keep them going season after season with a minimum of maintenance. Your Allis-Chalmers construction machinery dealer will be glad to show you an HD-21 or HD-16 soon. Allis-Chalmers, Construction Machinery Division, Milwaukee 1, Wisconsin.

move ahead with

ALLIS-CHALMERS

power for a growing world

HOLDS LOAD "RIGHT THERE"

SMOOTHER THAN STEAM

DRILLED OVER 22,000 HOURS AND STILL GOING STRONG

Run a torque converter on a drilling rig for over 22,000 hours without laying a wrench on it and your profits are bound to look good. Right?

You can bet they will – for you'll not only save money on repairs, but on lost drilling time too.

And that's exactly what Crow Greyhound Drilling Company of Shreveport, La., is doing by using TORQMATIC Converters on three of its drilling rigs. The converters on one rig have racked up more than 22,000 hours of trouble-free service. In all that time, *the only thing Crow Greyhound Drilling Co. did to the converters was normal preventative maintenance.*

But it's not just TORQMATIC's trouble-free performance that's saving money for Crow Greyhound Drilling Co. They're also drilling faster, making faster round trips, spending less on rig maintenance because of the "smoother than steam" power transmission. Inch-by-inch control saves time on fishing jobs–and drill strings last longer with TORQMATIC absorbing the shocks.

You can make more–save more–with TORQMATIC DRIVES working for you on your drilling, fracturing, or servicing jobs. They're available from most leading oil field equipment manufacturers. See your dealer for details, or write Allison Division, General Motors, Indianapolis 6, Indiana. In Canada: General Motors Diesel Limited, London, Ontario.

Allison

TORQMATIC® DRIVES

THE MODERN DRIVE FOR MODERN EQUIPMENT

compare

TORQUE · PERFORMANCE · DEPENDABILITY

BUY A...

AIR or ELECTRIC

IMPACT WRENCH

Air impact wrenches deliver

up to 15% more torque

while consuming 30% less air!

NO. 322

Superiority of their mechanical design is revealed in the unusual efficiency of SIOUX Air Impact Wrenches. Wrench for wrench, model for model, size for size, SIOUX can be counted upon to deliver an average of 15% more torque, while consuming 30% less air! Less power is absorbed by the wrench itself. More is applied to the drive. Three SIOUX wrenches can be operated on the existing air supply for every two of another kind. This correctness of engineering design has also produced a wrench of superior endurance, longevity, and freedom from trouble. Low first cost, higher torque, lower air consumption and long trouble-free life add up to make SIOUX THE BIG BUY IN AIR IMPACT WRENCHES!

No guess work with . . . . CERTIFIED SIOUX POWER

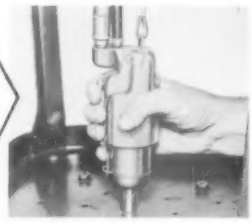
When it's a SIOUX, you know what it will do! SIOUX tells you the torque your air or electric impact wrench will deliver. You don't buy just a wrench. You buy certified SIOUX power, reversible power, and on air wrenches controllable power through eight point power selector.

REACTION BALANCED for Less Vibration Feed Back

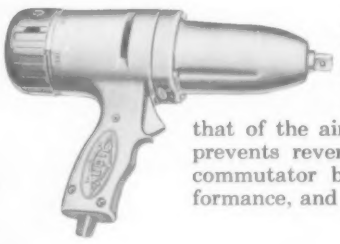
All SIOUX Impact Wrenches are "reaction balanced" for less vibration and torque feedback and for minimum operator fatigue. There's less shock and twist when the wrench impacts. You can feel the difference!

A SIZE FOR EVERY NEED!

From the big No. 322 SIOUX Air Impact Wrench (upper left) capable of up to 1,000 foot pounds of torque at 90 pounds of air pressure, to the little No. 313 (pictured at right) which weighs 2½ pounds and can deliver up to 80 foot pounds of torque, there's a full range of SIOUX impact wrench sizes and models.



SIOUX Electric IMPACT WRENCHES



SIOUX Electric Impact Wrenches offer equal power in right or left hand rotation. The torque for each wrench is stated and certified. Their mechanical design offers exactly the same advantages as that of the air wrenches. Their exclusive reverse cap switch lock prevents reversing with the current on, and eliminates burning commutator brushes and switch contacts. Their efficiency, performance, and freedom from trouble are unexcelled.

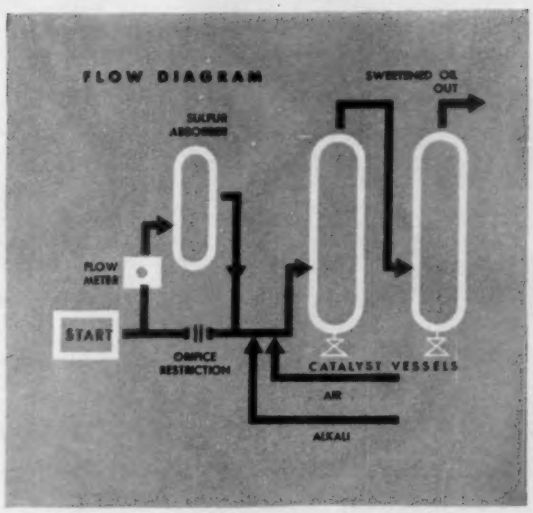
Look under **"TOOLS, ELECTRIC"** *in the Yellow Pages*

ALBERTSON & CO., INC.

SIOUX CITY, IOWA • U.S.A.

AIR IMPACT WRENCHES • AIR SCREWDRIVERS • ELECTRIC IMPACT WRENCHES • ELECTRIC SCREWDRIVERS • DRILLS • GRINDERS • SANDERS • POLISHERS • FLEXIBLE SHAFTS • PORTABLE SAWS • VALVE GRINDING MACHINES • ABRASIVE DISCS

PRODUCT IMPROVEMENT WITH **PETRECO**



IF SWEETENING IS ONE OF YOUR REFINERY PROBLEMS...

these facts about PETRECO* BENDER Catalytic Sweetening† may show you the answer:

LOW OPERATING COSTS: The average treating costs of Petreco Bender treating units are about 0.5 cents per barrel. Copper chloride or doctor treating costs, exclusive of amortization, generally exceed 1.0 cents per barrel. *The value of the volume loss in doctor treating alone often exceeds the total operation and amortization costs of Petreco Bender catalytic sweetening.*

SWEET NON-CORROSIVE PRODUCT: As compared to doctor treating, less sulfur is used, resulting in the delivery of a consistently non-corrosive product. *The use of less sulfur also lessens octane loss.*

ELIMINATES AIR AND WATER POLLUTION: Processing is in a closed system, eliminating air pollution and the attendant safety hazards. This eliminates open batch type agitators, thereby assisting in safety programs. *There is no "black strap" carry-over or carry-under to contaminate waste disposal systems.*

The product from the Petreco Bender unit is low in trace metal ions. Where a water wash is required to meet local product specifications, emulsion problems are not encountered due to the cleanliness of the Bender treated oil.

The only spent alkali withdrawn from the Bender unit each day is the small amount not consumed in the process.

HIGH YIELD: There is no volume loss in the system other than sampling and spillage. The volume loss in other sweetening processes is the greatest expense factor.

CONTINUOUS REGENERATION NOT NECESSARY: The catalyst retains its activity for long periods of time. This is made possible by the continuous addition of small quantities of air and alkali. Catalyst life without reactivation is usually two years or more. *Two Petreco Bender plants have been operating for over three years without any reactivation of the original catalyst.*

LOW INSTALLATION COST: *Unit cost for new equipment is comparatively low, ranging from $15 to $30 per barrel of daily throughput capacity.* If existing vessels are available and appropriate for conversion, this cost can be substantially reduced. Very often the charge may be taken directly from a distillation unit with existing pumps, exchangers and instrumentation, reducing the installation cost further.

SMALL TREATING AREA REQUIRED: Where ground areas are congested, the area occupied by any treating unit is of great importance. The plot dimensions for a 5,000 bpd Petreco Bender unit, for example, would be approximately 20′ x 35′.

*PETRECO is a registered trademark of Petrolite Corporation.

† *For middle range distillate streams such as kerosine, stove oil, light gas oil, No. 2 fuel oil, coker naphtha and catalytic gasoline.*

B-60-2

PETROLITE CORPORATION

PETRECO DIVISION
3202 South Wayside Drive (P.O. Box 2546), Houston 1, Texas
1390 East Burnett Street (P.O. Box 7216), Long Beach 7, California

CANADA: Petreco, 4528 Stanley Drive, Calgary, Alberta
COLOMBIA: South American Petrolite Corporation, Bogota
ENGLAND: Petrolite Limited, 20 Savile Row, London W.1
GERMANY: Petrolite Anlagenbau und Vertriebsgesellschaft m.b.H., Frankfurt a. M.
VENEZUELA: South American Petrolite Corporation, Hotel Avila, Caracas

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BRAZIL: WERCO, Ltda., Rio de Janeiro
ITALY: NYMCO, S.p.A., 9 Lungotevere A. da Brescia, Rome
JAPAN: Chiyoda Chemical Engineering and Construction Company, Ltd., Tokyo
KUWAIT: F. N. Dahdah, Box 1713, Al Kuwait
MEXICO: R. E. Power, Sierra de Mijes No. 125, Mexico, D. F.
NETHERLANDS: F. E. C. Jenkins, Hoefbladlaan 134, The Hague
TRINIDAD: Neal and Massy, Ltd., P. O. Box 544, Port of Spain

Loading of this portable drill rig was started at 6:30 A.M., and Macks are ready to haul it to new location in Cadiz Field, Live Oak County, Texas—32 rugged cross-country miles away.

ON SCHEDULE—REGARDLESS

"Here's why we operate with the best equipment we can buy," says H. L. (Brownie) Choate, veteran oil field trucker of Alice, Texas.

"One thing you can't afford in this fast-moving business is on-the-job truck breakdowns or bogdowns . . . even though you have to make your drilling equipment move on schedule, never knowing exactly what you're going to run into, or what your trucks will be called on to do.

"On-the-job breakdowns have become a thing of the past since we made Macks the backbone of our fleet. And as for bogging down, experience has convinced us that Mack's four-wheel drive Balanced Bogie with Power Divider will pull through anything that we, or anyone else, will run into in this business."

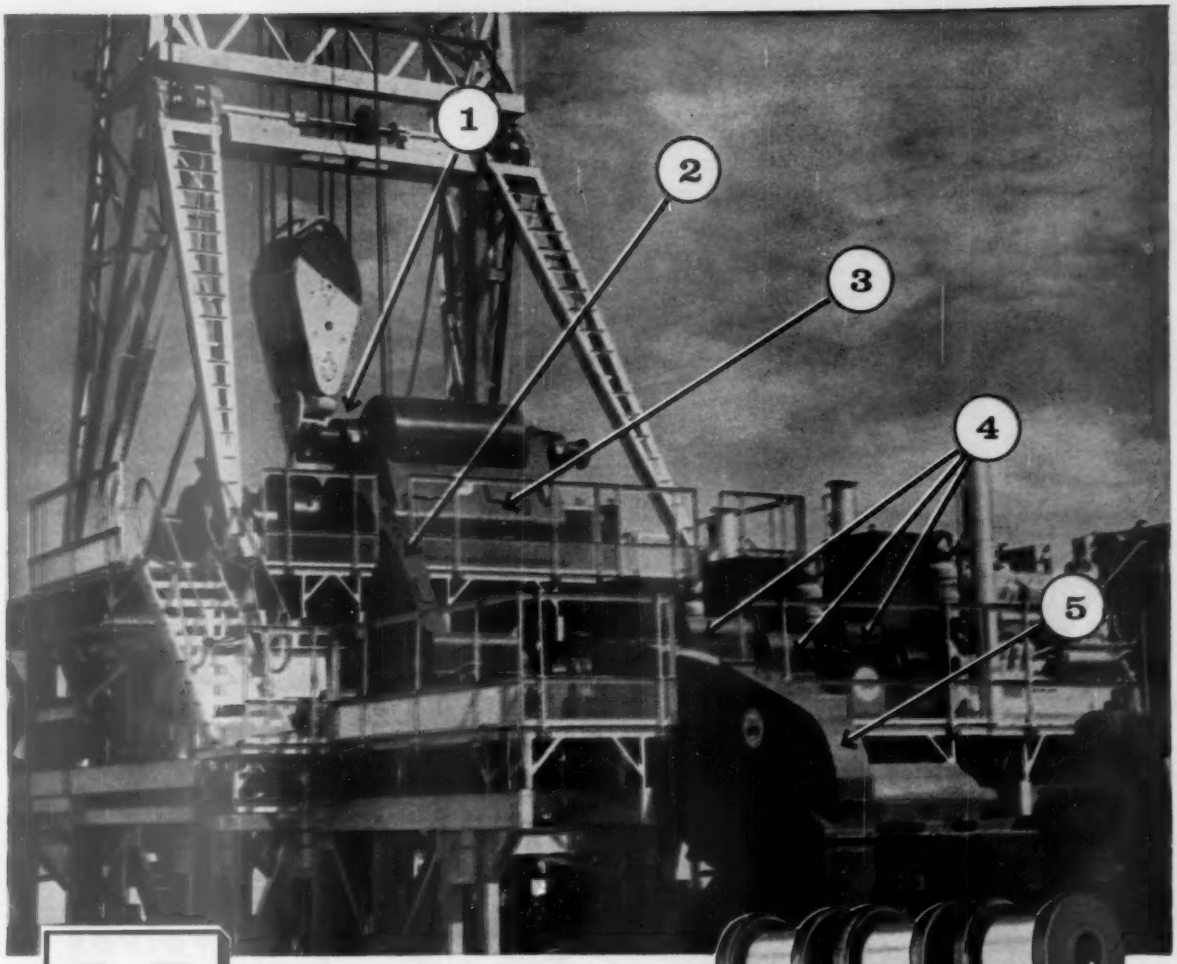
Brownie Choate and his experienced truck pusher "Boots" Niehaus know their job . . . and their Macks. They expect rugged working conditions, and they're ready for them with trucks that are built to take on the roughest, toughest jobs in the oil fields.

Your Mack branch or distributor will show you why Mack trucks can save you plenty in terms of downtime, delays and headaches. Mack Trucks, Inc., Plainfield, New Jersey. In Canada: Mack Trucks of Canada, Ltd., Toronto, Ontario.

MACK
FIRST NAME FOR
TRUCKS

At new drilling site, Macks go to work setting up rig platform. Terrain proved unexpectedly bad but the trucks were there on schedule. On-the-job performance comparisions switched H. L. Choate to Macks.

New rig platform nearing completion as Macks spot heavy platform sections. Jobs like these call for fast, sure teamwork between trucks and crews. This job was cleaned up in 6½ hours . . . thanks to capable equipment.

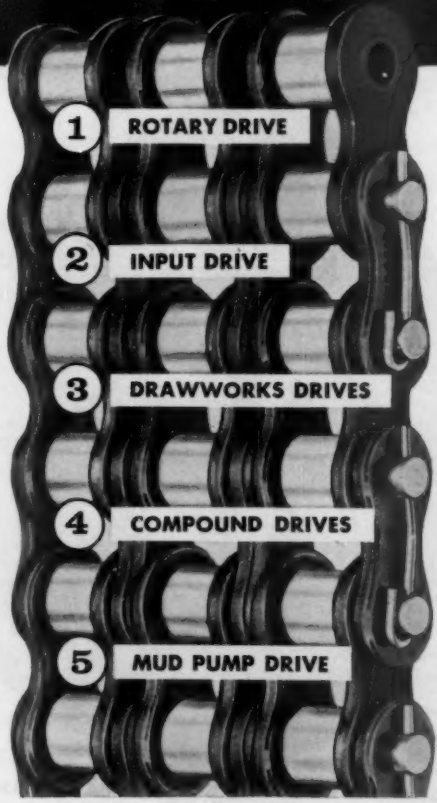


Throughout

today's foremost rigs you see LINK-BELT FR® roller chain

THIS National Supply Company rig relies heavily on Link-Belt FR (Fatigue Resistant) roller chain . . . as do countless other industry leaders. The reason? *No other roller chain has greater capacity to withstand the smashing impacts and tortuous stresses met in day-to-day drilling.* This tremendous endurance is a result of Link-Belt's patented FR process . . . a unique method of strengthening critical sidebar areas most vulnerable to fatigue failure.

FR is standard with all Link-Belt oil field roller chains. So are these other Link-Belt *dynamic strength extras:* close heat-treat control, pre-stressing, pitch-hole preparation, shot-peened rollers. Complete details are contained in Catalog 2880 . . . available at any leading supply store.



LINK-BELT

ROLLER CHAINS AND SPROCKETS

LINK-BELT COMPANY: Indianapolis 6, Houston 1, Dallas 26, Odessa, Tex., New Orleans 16, Shreveport, La., Los Angeles 22 (Montebello), Scarboro (Toronto 13); Export Office, New York 7. Distributors in All Fields. 10,120

POWELL

LUBRICATED PLUG

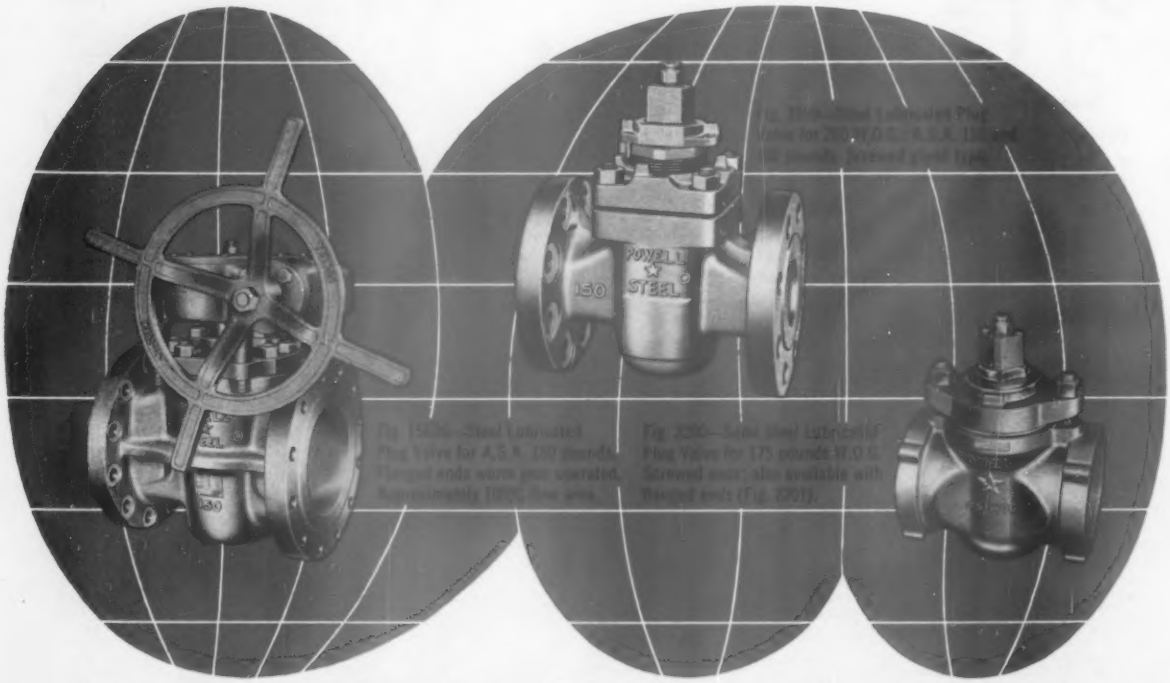
VALVES

performance that makes a world of difference

For over a century, Powell has supplied vital valves to the all-important oil industry. Today, the complete line includes valves of all types. Powell has the greatest variety of sizes, designs, pressures and metals. There is one to cover every valve need in oil refineries, petrochemical installations, and storage facilities everywhere.

Powell engineers and metallurgists will gladly make a special analysis of your requirements and submit recommendations to fill all your valve needs. Write directly to us . . . or consult your local Powell distributor.

Powell . . . world's largest family of valves



THE WM. POWELL COMPANY • DEPENDABLE VALVES SINCE 1846 • CINCINNATI 22, OHIO

Continental-Emsco's PRECISION HERE

. . keeps wells pumping longer

C-E's D+B pump shops are manned by trained, field experienced specialists using modern equipment and methods. The result: *superior service.*

Precision micrometers, gauges and special test equipment are used to check OD of plungers . . ID of liners and tubes . . pressure-test pumps after assembly. Special C-E designed aligning mandrels and clamps are used to accurately assemble and repair sectional liner pumps and composite plungers. Special vises prevent distortion of tubes and plungers. The use of friction tongs eliminates pipe wrench marks . . open doors for corrosive fluids. Vacuum testers are used to test fluid seal of valves. Desanding equipment is used to remove frozen plungers and entire pumps from sanded joints often saving considerable money by salvaging parts. Cooking vats and steam cleaning equipment remove paraffin and other deposits and also eliminate corrosive effects of salt water during pump repair. Each shop has special equipment to handle the popular pumps of the area.

Continental-Emsco's training program keeps personnel "up" on all types of pumps, improved methods of assembly and new materials. You always get a longer *pumping* run for your dollar at Continental-Emsco D+B pump shops.

For Service that Sings . . Equipment that Hums . . Go . .

CONTINENTAL-EMSCO

Serving the Oil and Gas Industries ... Worldwide

CONTINENTAL-EMSCO D+B PUMP SHOPS

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SOUTH TEXAS
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Sundown
Kermit

Rocky Mountain States

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Rangely
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Glendive

NEBRASKA
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NEW MEXICO
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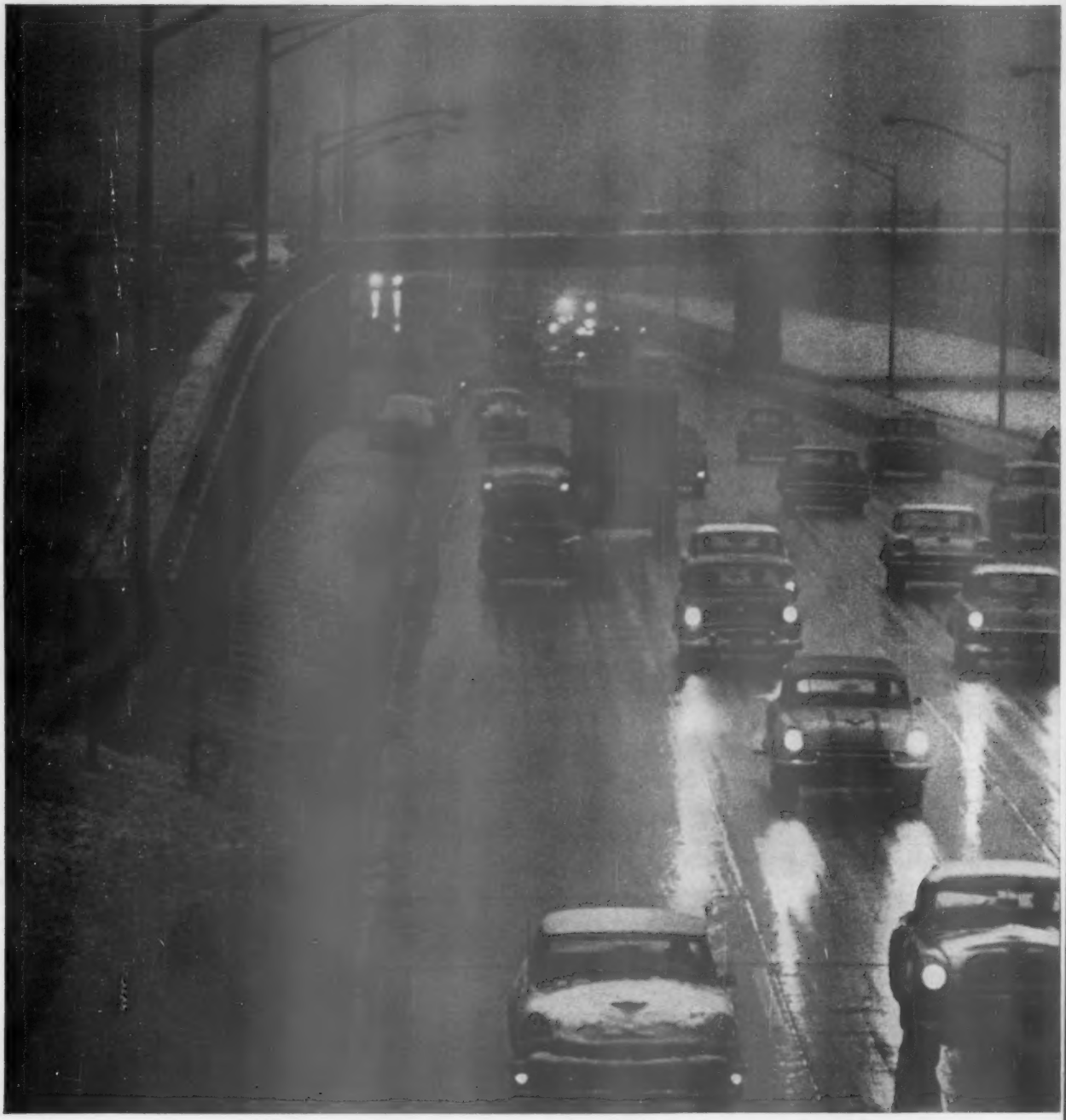
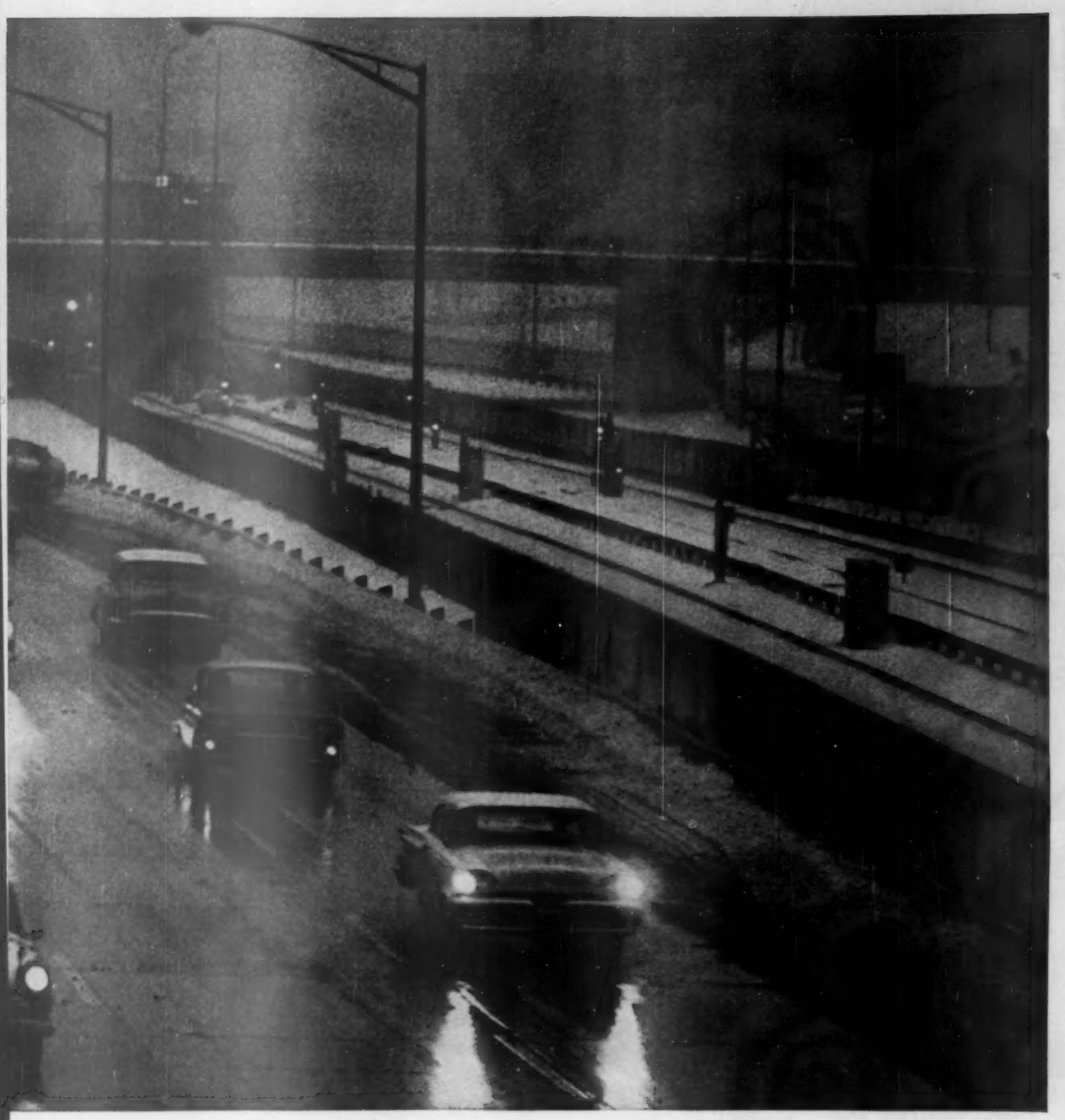


ARMOUR ANTI-STALLING ADDITIVES

Armour's **Duomeen**® compounds have been used successfully by major oil refiners the past several years to prevent carburetor icing. These anti-stalling additives are so effective that they are used on a ppm basis . . . amounts so small your costs are reduced to a fraction of what you pay for protection gained by the use of freezing-point depressants.

In addition to their anti-stalling properties, Armour's additives also help prevent corrosion and keep air-borne contaminants from forming on carburetor walls and parts. To reconfirm their savings and effectiveness in operation, an independent laboratory runs continuing tests on these Armour additives. Test results consistently establish the superior prop-



KEEP 'EM ROLLING AT LESS COST

erties and economies of these Armour additives over freezing-point depressants.

Armour also makes a wide variety of chemicals as specialized additives for automotive uses. These polar nitrogen compounds have a broad range of use. In addition to preventing corrosion in greases, lube oils and gasolines, these compounds also improve lubricity in lubricating oils, transmission fluids and greases.

To learn more about Armour's gasoline anti-stalling additives and other refined product additives, and to receive samples of them, write to:

ARMOUR INDUSTRIAL CHEMICAL COMPANY
A DIVISION OF ARMOUR AND COMPANY
110 North Wacker Drive, Chicago 6, Illinois

FOUND IN THE FOUNDRY

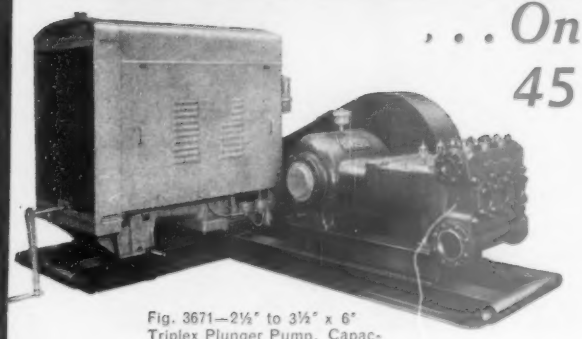


Fig. 3671—2½" to 3½" x 6" Triplex Plunger Pump. Capacities of 191 to 375 barrels per hour at working pressures from 1575 to 800 PSI.

. . . One of the Secrets of GASO'S 45-Year Record of Leadership

No pump is stronger than the metal from which it is made, and no pump manufacturer casts his metal to more rigid specifications than Gaso. Here experienced foundry-men are preparing the mold for a Gaso power frame. Into it will be poured a special formula of molybdenum alloy cast iron. Test bars, sent regularly to a nationally known laboratory, consistently show a tensile strength of 45,000 to 48,000 lbs. per square inch. Another reason for the ruggedness of Gaso Pumps, their ability to withstand the shocks and strains of tough use, and their habit of outliving ordinary pumps . . . Latest catalog on request.

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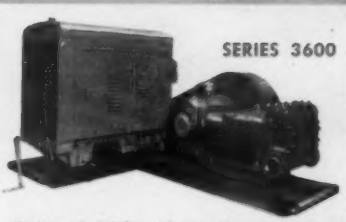
GASO PUMPS
for every oil industry need

GET GASO DEPENDABILITY IN WATER FLOODING, TOO

Gaso Pumps in operation at a water flooding pilot plant in Venezuela

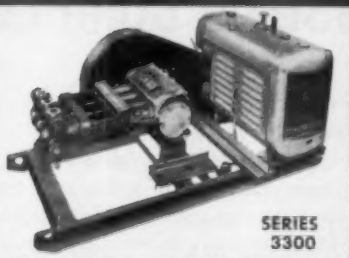
The same time-tested characteristics that established Gaso Pumps as leaders in pipe line service have made them the outstanding choice in water flooding service. More service per pound of weight or dollar of cost. Longer life with less maintenance. Rugged compactness. Above all, the assurance of dependable performance, with types and sizes that assure adaptability to the job.

Gaso distributors are qualified by training and experience to help you find the effective answer to any problem associated with water flood service. You will find them listed on the opposite page. Latest catalog on request.



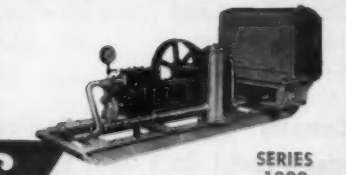
SERIES 3600

Horizontal Triplex Plunger Pumps with 6" stroke and either of two fluid ends. The large capacity fluid end (Fig. 3671) takes 2½" to 3½" plungers and operates with pressures from 1575 to 800 psi. Small fluid end (Fig. 3670) takes 1½" to 2¼" plungers and operates with pressures from 3750 to 1935 psi.



SERIES 3300

2¼" x 3" Horizontal Triplex Plunger Pump designed for rugged, high-pressure service. Extraordinary performance (up to 44 Bbls. per Hr.), time-tested Gaso design features in a pump that weighs only 720 pounds.



SERIES 1800

Fig. 1849 takes 2½" to 4" pistons and operates with pressures from 900 to 350 psi. Fig. 1847 takes 2½" to 4½" pistons and operates with working pressures from 900 to 275 psi.

GASO PUMPS
for every oil industry need

CAREFUL STUDY DICTATES CHOICE OF PUMPS

GUESSWORK AND HUNCHES OUT IN PRESENT-DAY BUYING PRACTICE

Guesswork, hunches, even personal preferences, have no place in the present-day selection of pumps for pipe line, water flooding and other projects.

Today efficiency-conscious management insists on the selection of pumps which, through investigation, prove to measure up in greatest degree to the concept of maximum performance per dollar expended.

These facts were brought out in a study of recent sales by Gaso Pump & Burner Manufacturing Co. Among the yardsticks used to govern pump selection are:

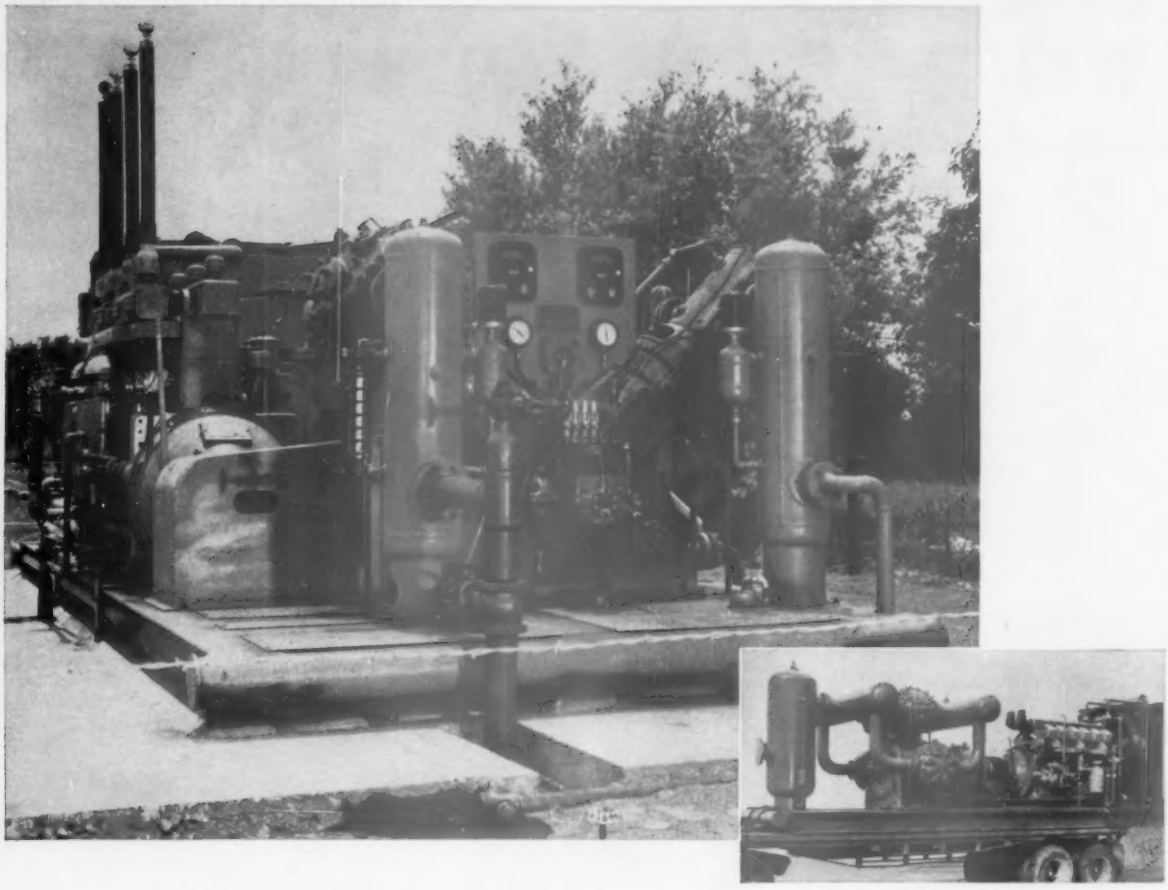
Completeness of line, assuring models and types best suited to specific conditions.

Performance record, embracing a study of service, service life, operating and maintenance costs.

Responsibility of manufacturer.

Follow-Through Service, with special emphasis on the availability and immediate delivery of parts.

For the Gaso company, selection based on investigation is a welcome practice. Any study by prospective customers will reveal a complete line of pumps in the Gaso capacity range, with a 44-year record of dependable, economical performance. Significantly, parts are still available for any standard model ever built by Gaso—with service calls which indicate that many of its earliest models are still in operation.



INTERCHANGEABLE CYLINDERS MAKE JOY GAS COMPRESSORS COMPLETELY FLEXIBLE

For unknown conditions in the well, or for rapidly changing conditions, only Joy gas gathering compressors give you the flexibility you need.

If operating conditions change, you can vary the compressor capacity by changing the cylinder liners. For extreme changes in operation, you can change the complete cylinder assembly, because *any Joy cylinder fits any Joy frame.* All cylinders accommodate a 7″ piston stroke, and all Joy compressors operate at 600 rpm.

This modern uniform design gives you a gas booster that fits any condition, any service . . . even moves to other locations. The entire unit is designed within normal size limits for highway transportation. For the flexibility you need in gas boosters, see your nearest Joy distributor-fabricator listed here, or write for bulletin 1211-31.

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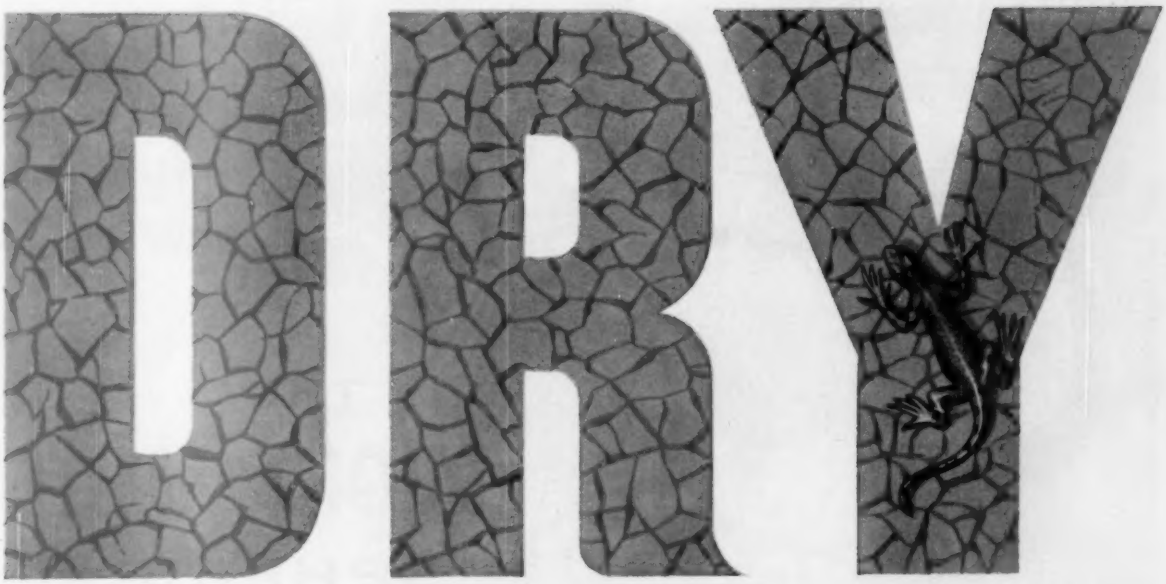
When gases must be



Davison Hi-Sorb Silica Gel dries better

Water and moisture are wonderful things to have WHERE you want them. But in natural gas dehydrators . . . in gas streams . . . in the refinery, where your efficiency depends on dryness, it is natural that Davison Hi-Sorb Silica Gel is the usual choice. One cubic inch of Davison Silica Gel provides an absorptive surface area of 90,000 square feet. Davison Silica Gel prevents hydrate formation which clogs lines, causes high pressure losses and high maintenance costs. It decreases corrosion in equipment. It reduces power costs in compression. And most important, it keeps customers happy. There's nothing better obtainable. Write Dept. 31302 today for full information.

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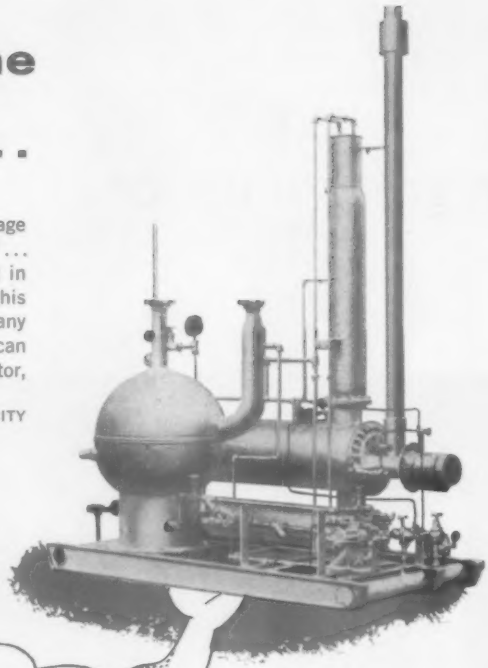
The "Little Guy" with the BIG Performance....

A skid-mounted base no larger than the top of an average desk... a spherical absorber no larger than a basketball*... that's the Parkersburg Mighty-Mite, the biggest little unit in the business. Easily housed for cold-weather conditions, this compact concurrent-flow dehydrator will operate in any climate, can guarantee a dewpoint depression of 60° F., can dehydrate up to 10MMCF of gas. Where economy is a factor, consider the Mighty-Mite first for efficient dehydration.

* for 3MMCF/DAY CAPACITY



THE MIGHTY-MITE SPHERICAL GLYCOL UNIT

- Reduces purchase, operation and maintenance costs.
- Assures simple, trouble-free operation.
- Ideal for offshore operations because of its light weight, space-saving size.
- Reboiler operates at temperatures 30° to 45° lower than conventional glycol dehydrators.
- Utilizes lower cost diethylene glycol.

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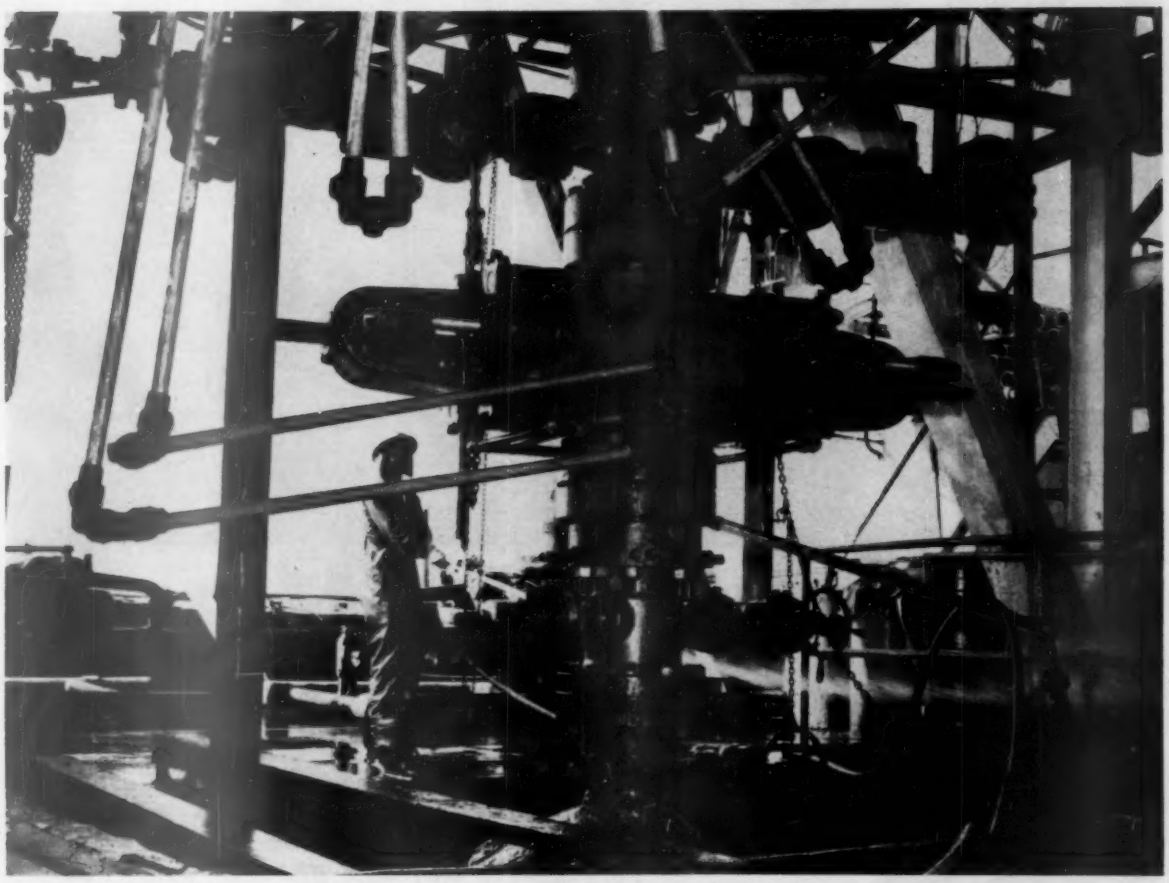
ON BLOWOUT PREVENTER LINES–

Chiksan Swivel Joints insure high safety factor



Chiksan Joints and Weco Unions on blowout preventer lines in offshore operations in Galveston Bay.

Convincing proof that Chiksan Swivel Joints measure up under severe conditions is shown in the following destruction test report: "In open flame trials, Chiksan Swivel Joints, under pressure of 1800 PSI, were subjected to flames reaching 650°F. The Swivel Joints functioned satisfactorily for a full 60 minutes—55 minutes longer than the time deemed necessary for the effective operation of the blowout preventer."

In foul weather and in rough handling Chiksan Joints stand up best. Long service life and minimum maintenance are other major reasons for selecting Chiksan.

Standardize on Chiksan Swivel Joints for all your drilling and production needs. You'll find Chiksan Joints and their partner Weco Unions in major supply stores everywhere.

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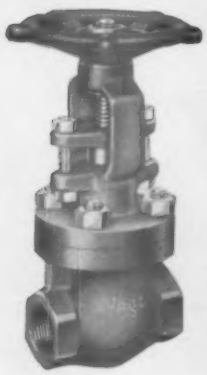

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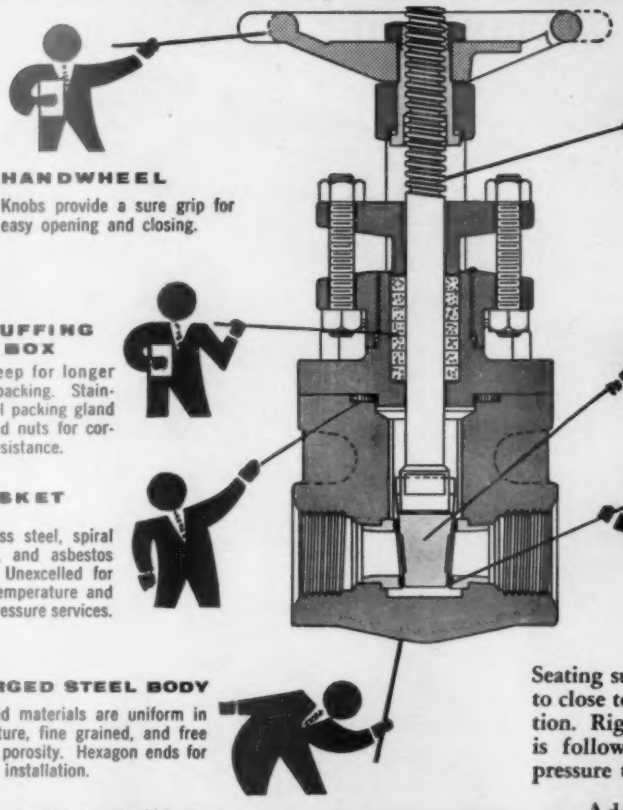
2000 POUNDS COLD, W.O.G.
SIZES ¼" THRU 2"

A NEW Vogt

with 7 superior features



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Knobs provide a sure grip for easy opening and closing.

2 STUFFING BOX

Extra deep for longer life of packing. Stainless steel packing gland studs and nuts for corrosion resistance.

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Forged materials are uniform in structure, fine grained, and free from porosity. Hexagon ends for easy installation.

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13% Chrome stainless steel. A special high melting point alloy yoke nut assures prolonged wear resistance.

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13% Chrome stainless steel of approximately 500 Brinell for longer wear.

7 SEATS

13% Chrome stainless steel, hard faced with *HAYNES STELLITE or equivalent for stubborn resistance to seat wear.

Seating surfaces are precision machined to close tolerances for drop tight operation. Rigid inspection of finished parts is followed, after assembly, by final pressure tests of body and seats.

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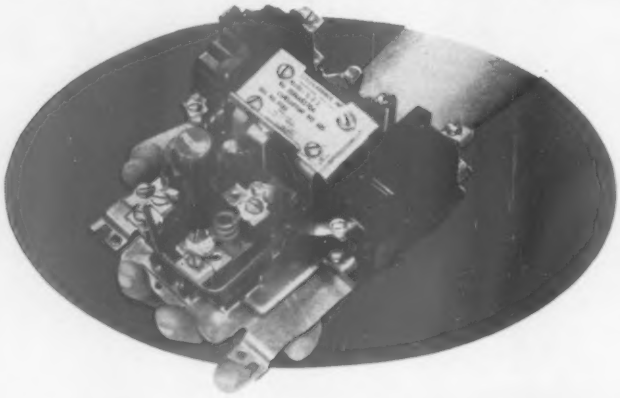
FORGED STEEL

VALVES

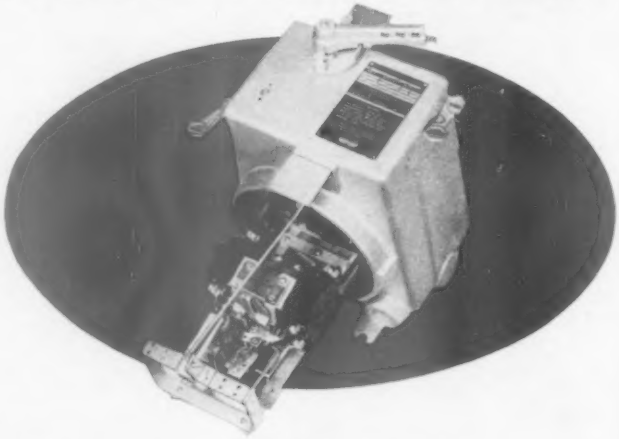
Nothing left to chance...

CUTLER-HAMMER MOTOR CONTROL



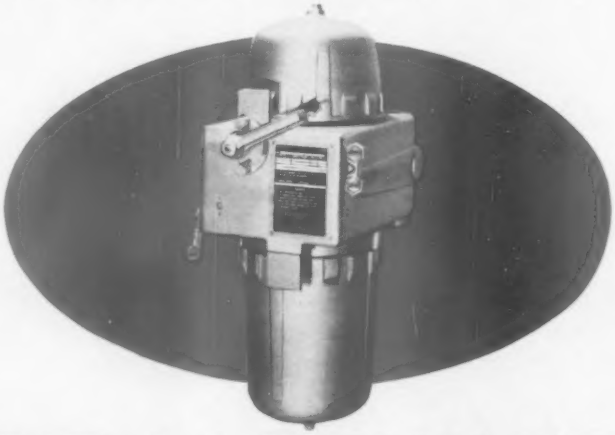
in

CROUSE-HINDS EPC CONDULETS®



for

HAZARDOUS LOCATIONS



Experienced oil men leave nothing to chance when selecting motor control for hazardous locations . . . they specify Cutler-Hammer Three-Star Motor Control in super-safe Crouse-Hinds EPC Condulets.

Crouse-Hinds cast aluminum enclosures are easy to install. Non-binding threads between the caps and body facilitate installation and inspection. Unitized control panels are removable by two screws, providing maximum wire-pulling freedom. Straight-through control wiring to clearly marked terminals eliminates accidental wiring errors.

Cutler-Hammer Three-Star Motor Control works better, lasts longer. Tests prove super-life vertical contacts out-perform all others never requiring time or attention in 90% of its uses. Adjustable overload relays are accurate to within 3% of full load motor current instead of the usual 10% or 12% . . . motors work at rated capacity without nuisance tripping. And 3-coil overload relays fit the standard enclosures providing full three-phase overload protection.

Safe, dependable performance is assured when you use Cutler-Hammer Motor Control for all your requirements. Now available in combination starters, NEMA size 0 through 4. See your authorized Cutler-Hammer Distributor today. Cutler-Hammer Inc., Milwaukee 1, Wisconsin.

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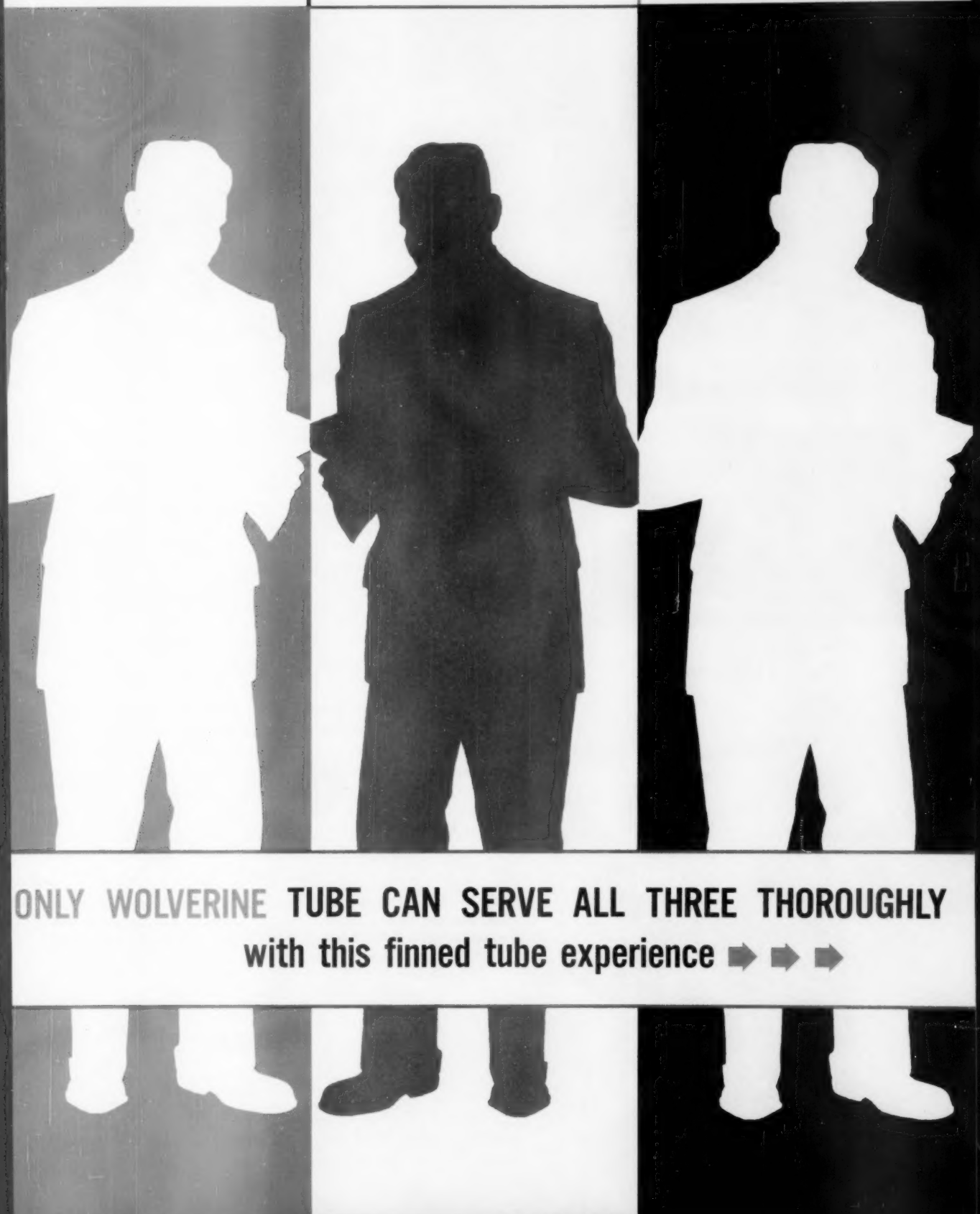

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with this finned tube experience ➡ ➡ ➡

THERE'S NO BETTER BUY THAN COMPLETE SERVICE

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Wolverine Trufin®—the integrally finned condenser tube is available in a wide choice of metals, alloys and sizes in Types H/A, H/R, I/L, L/C, S/T. These various tubing types differ in fin heights and fin spacings. Duplex tubes with inner and outer tubes of different metals are available in types S/T and L/C. They are also available with four distinct types of end treatments. Wolverine also manufactures prime surface condenser tube in a wide range of sizes and alloys.

FIELD ENGINEERING SERVICE

For the benefit of its customers Wolverine's Field Engineering Service is staffed with tubing specialists who have specialized training in tubing, alloys and metallurgy, equipment design, heat transfer, etc. When you require heat transfer consultation, Wolverine has available a number of heat transfer specialists home based in the country's major processing areas. Their services are yours—without obligation.

FACILITIES

In addition to two tube manufacturing plants Wolverine also maintains a network of sales offices across the United States. Wolverine's Detroit, Michigan plant recently underwent a multimillion dollar modernization program that makes it one of the most modern tube mills in the United States. Its Decatur, Alabama plant, more than ¼-mile in length, is equally modern — is equipped with the finest machinery available.

We'd very much like your next tubing order. We're equally very sure you'll like our tubing and services. A telephone call to the nearest Wolverine Sales Office (we're in the Yellow pages) will start things rolling. May we hear from you soon?

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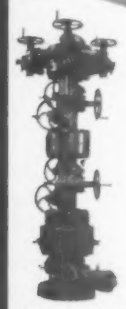
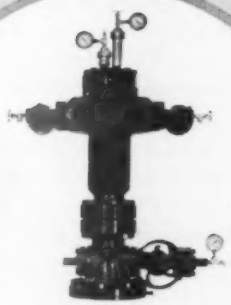
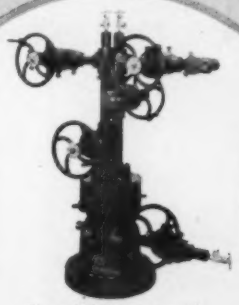
ASK THE O·C·T REPRESENTATIVE NEAREST YOU ABOUT A NEW SERIES OF LOW PRESSURE EQUIPMENT



Triple Block Tree



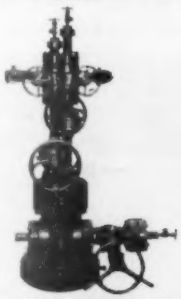
Dual Unitree



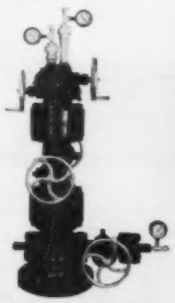
Threaded dual tree with Crescent Flange Bottom

Triple Tri-Flange Tree

Single Unitree



Crescent Flange Tree with Crescent Flow Controls



Dual Hookup with Dual Controls

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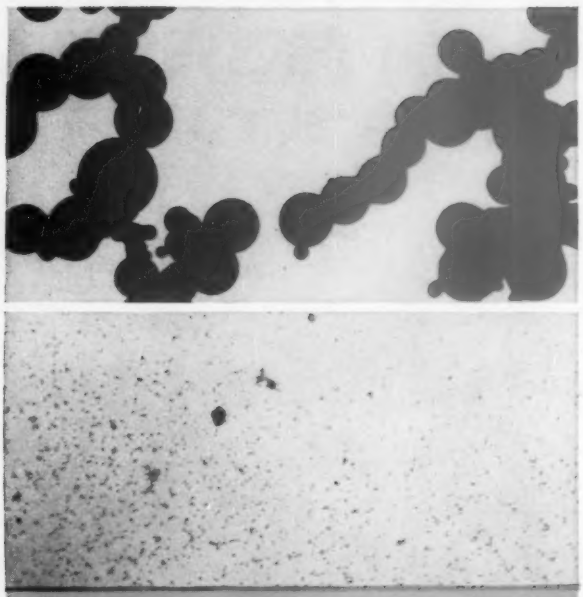


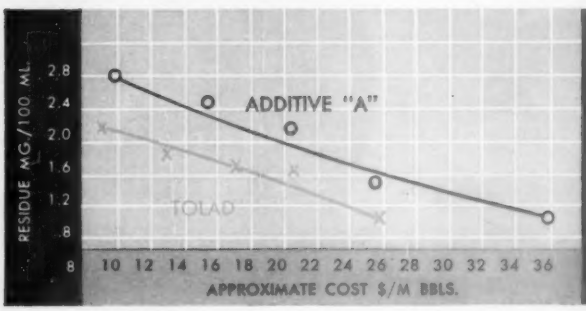
Above photomicrographs (magnification 6000X) show fuel oil samples after 12-week oven storage test. The upper photo is of a sample containing no additive, the lower sample photo contains TOLAD at commercial concentration. Note the fine particle dispersion attained by TOLAD Fuel Additive.

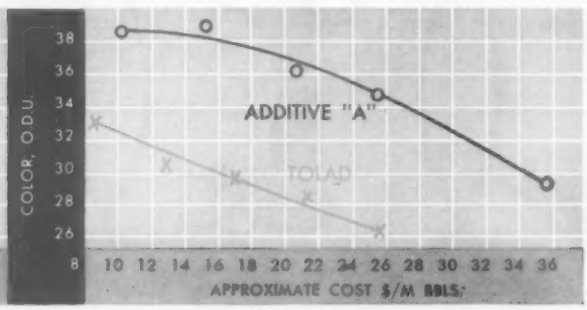
The use of TOLAD* Fuel Additive, by preventing deterioration of fuels in storage, enhances marketability and reduces customer complaints. TOLAD Fuel Additive prevents the formation of sludge and insoluble residue, the causes of fuel plugging in fuel lines, filters and burner tips. Insoluble residue also is a primary problem in diesel engine operation, causing fouling in fuel injection systems.

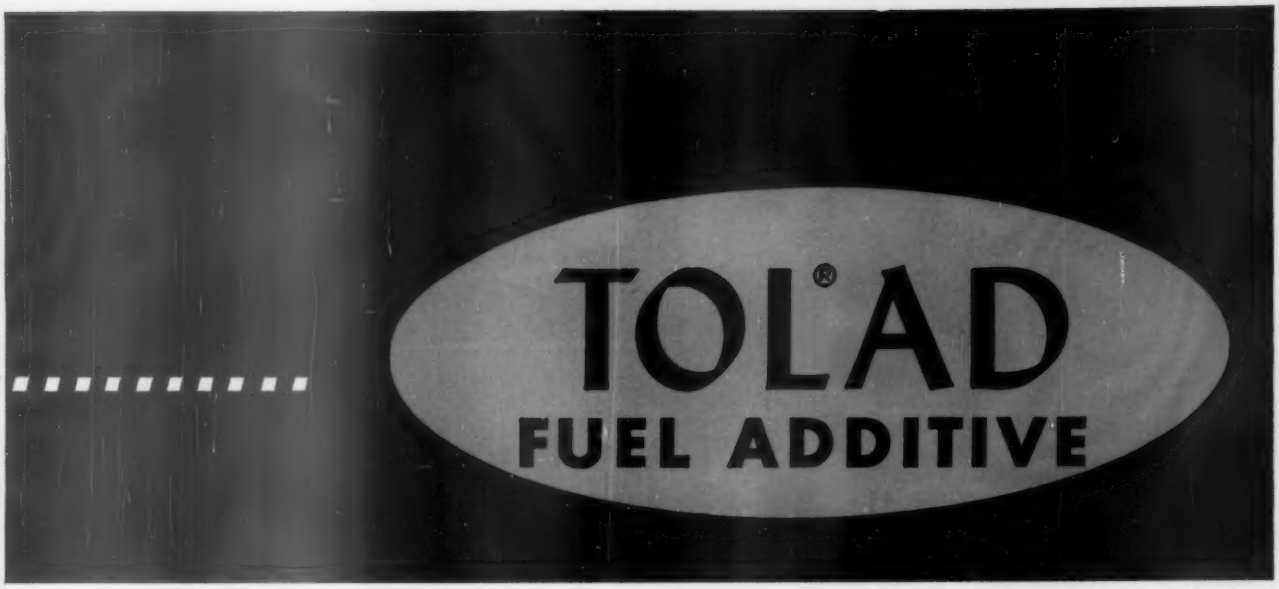
While TOLAD Fuel Additive is just being announced, it has been under laboratory test for over five years, and under controlled commercial testing for two years. As a result of these commercial use tests, six different refiners now use TOLAD on a routine basis. TOLAD Fuel Additive has been approved for use in diesel engine fuel by leading railroads.

One of the most important advantages of TOLAD Fuel Additive is its low cost. In two years of commercial use tests, TOLAD not only provided comparable *or improved* fuel stability for the fuels tested, but it consistently did so at a substantial cost advantage over the additive it replaced.

The graphs below illustrate the economic advantages of TOLAD over a well-known commercial additive. On fuel samples stored for 12 weeks at 110° F, the TOLAD-protected fuels showed less residue and better color, and always at a lower cost.







FA-60-1

added to domestic heating and diesel oils, TOLAD *improves their storage stability by . . .*

1. INHIBITING FORMATION OF INSOLUBLE RESIDUE

2. PREVENTING SLUDGE FORMATION

3. MAINTAINING COLOR STABILITY

TOLAD Fuel Additive is offered in a variety of formulations, all being ashless. TOLAD formulations are available, depending on the fuel oil characteristics, as inhibitors, inhibitor-dispersants, inhibitors with metal deactivator or inhibitor-dispersants with metal deactivator.

The Tretolite laboratories will test your fuel and recommend the TOLAD formulation most appropriate to insure stability improvement.

For complete information, ask any Tretolite refinery service engineer, or write to

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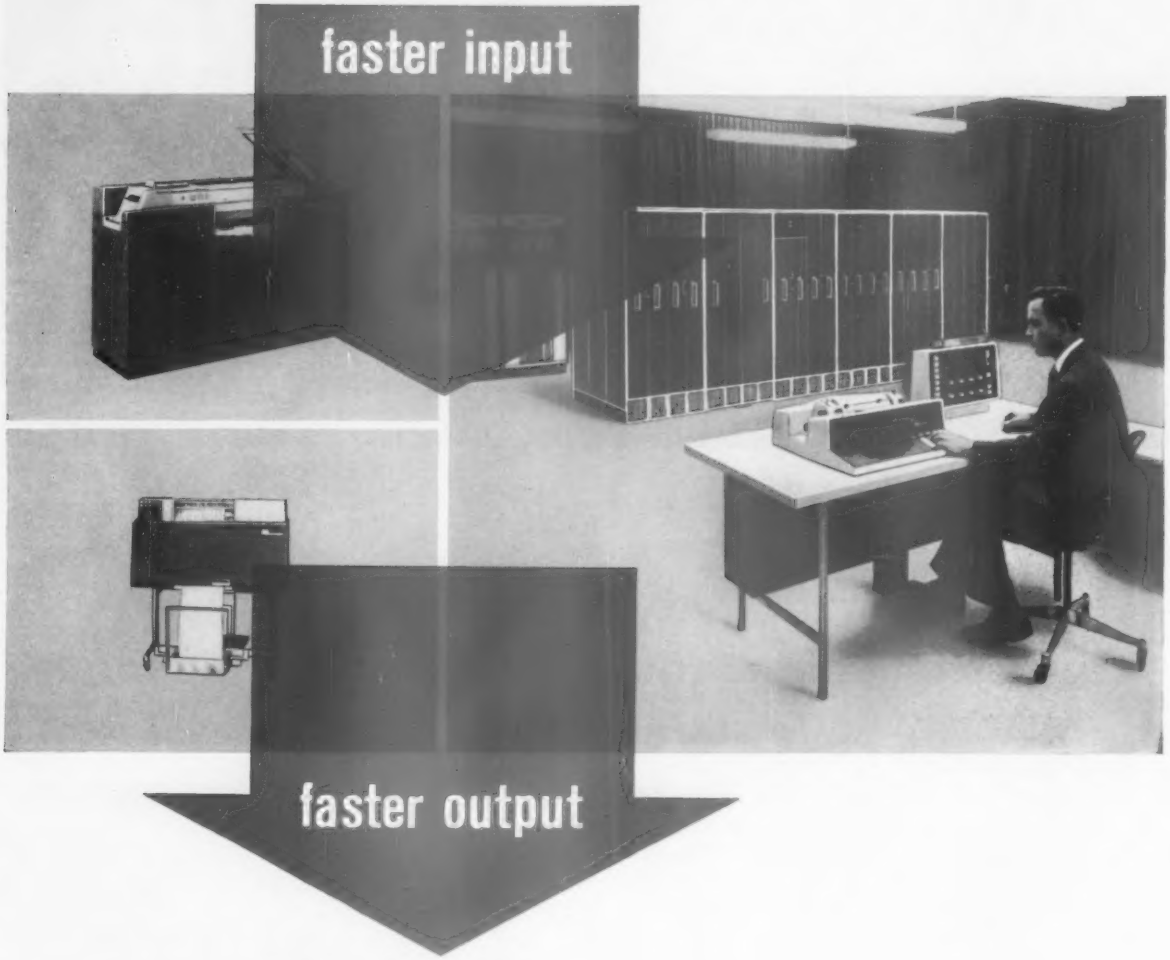
with IBM's new, high-speed 1401 System for



... the powerful IBM 7070 now packs even greater processing power

Greater flexibility in putting your problem on computer . . . greater speed in taking results off . . . greater flexibility in handling peripheral operations—these are the features that IBM's exciting new 1401 System brings to the IBM 7070. The 1401 balances input/output speeds to match the tremendous processing speed of the 7070, adds powerful off-line editing and programming facilities to free the computer for more profitable work. The total system—designated the tape-oriented IBM 7070—gives you lower job cost . . . more production per dollar.

The tape-oriented 7070 employs the 1401 System to boost card-to-tape conversion from 500 to 800 cards a minute. The 1401 also features an exclusive horizontal chain printer that turns out crisp, perfectly aligned copy at 600 lines a minute. This unique printer moves paper at magnetic tape speeds—up to three and a half times faster than conventional printers!

With these advances comes unusual flexibility. The tape-oriented IBM 7070 is a solid state, high-capacity system. It can be expanded from a single-channel 4-tape to a four-channel 40-tape system. It can read on one to four channels simultaneously with computing. And in keeping with IBM's concept of Balanced Data Processing, the 7070 is linked with comprehensive services ranging from personnel education and program planning through reliable service engineering.

For full information on the new tape-oriented 7070 call your IBM representative. Like all IBM equipment, the 7070 System may be either purchased or leased.

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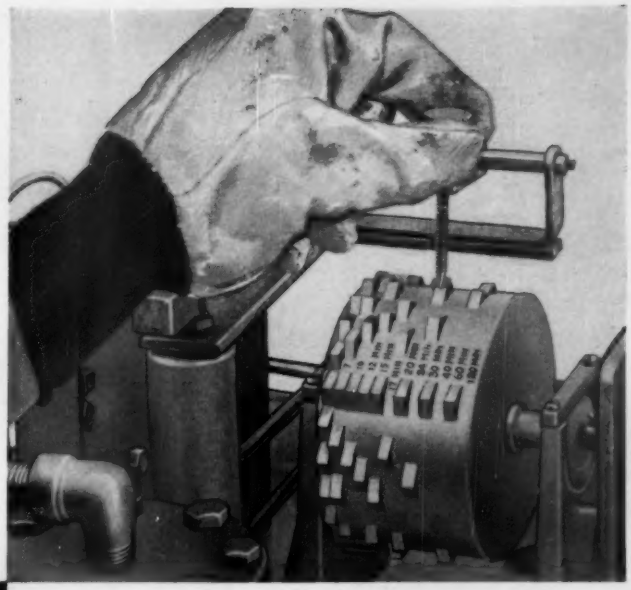
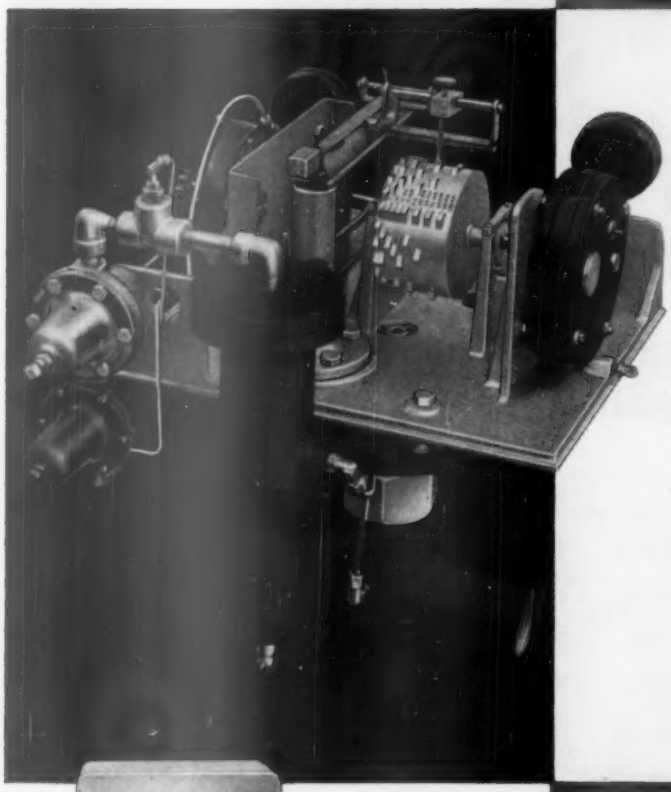
BALANCED DATA PROCESSING

Accurate Gas Lift Time Cycle Control With Finger-Tip Adjustments

GUIBERSON'S AF

Intermitter-Regulator





Here's a real *oil field tool.* A rugged, long lasting intermitter-regulator for gas lift, which can be accurately set by a field man *with his gloves on*.. no special tools needed.

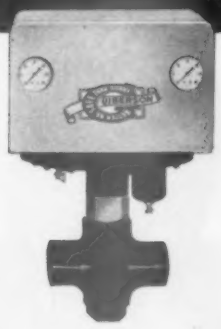
Note the intermitter-regulator with the cover removed. See how simple and trouble free the mechanism is.. no loose pins to set.. no tiny parts to adjust.

Select a time cycle by moving the adjusting screw along the slide bar until it lines up with the desired time embossed on the drum. Then set the injection time by turning the adjusting screw. Turning right increases.. left decreases.

Cycle frequencies are possible from an every five minute maximum to a minimum of one injection per revolution of the two-hour clock. Each cycle repeats with reliable accuracy.

For use as a pressure regulator, back off the adjusting screw until it clears timer drum tabs. Set to hold desired pressure with adjusting knob on the bourdon tube. It's as simple as that.

All parts are corrosion resistant and precision-made for long life and dependable service.



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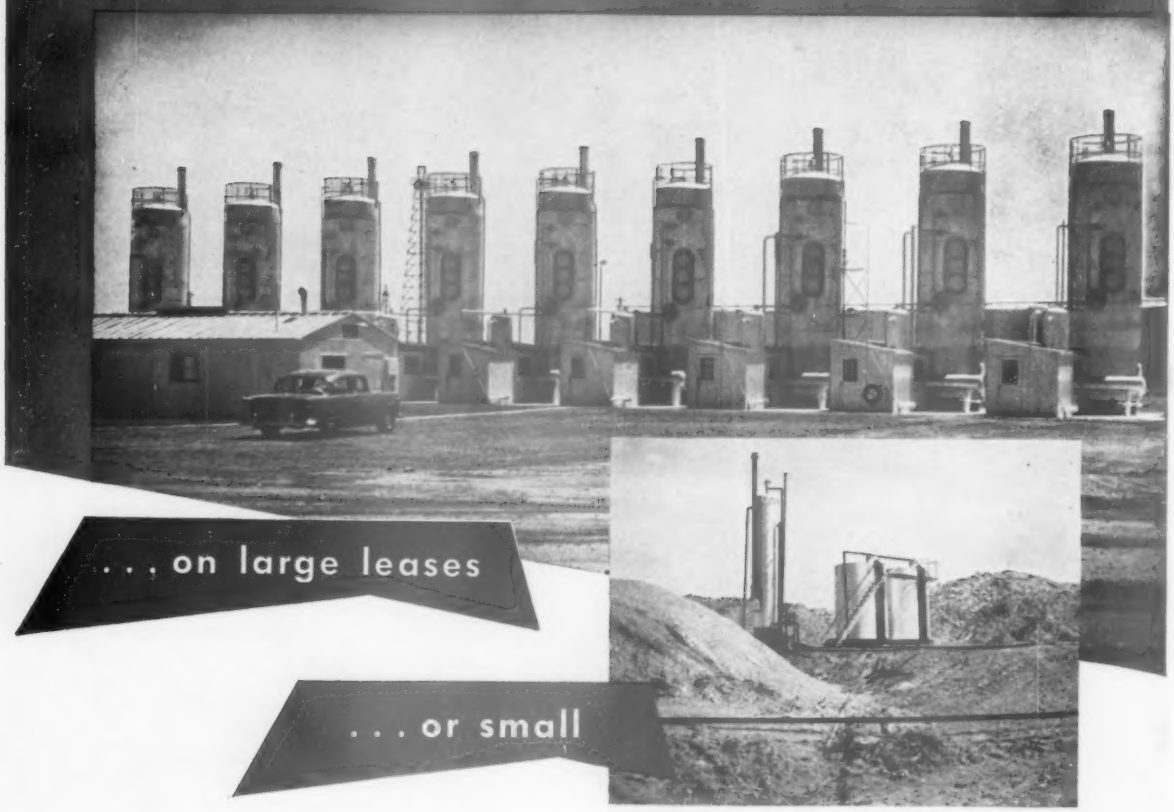

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Visco's emulsion-breaking economy goes clear across the board . . . big operations or small . . . tough- or easy-to-break emulsions. It makes no difference whether you need a drum of emulsion-breaker a day or one every six months—you can be certain your Visco Field Service Man will find the right formula to give you dry oil at lowest cost. For fast action, call Houston, JAckson 8-2495.

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They Say—

It's not mysterious

"It is often difficult to measure the positive values of favorable public opinion. But it never takes long to find out the penalties of a bad reputation.

"Public relations is as much a part of our daily affairs as the petroleum products we produce. Even though each of us as an individual may not sell a product or service directly to the average citizen, it would be hard to name an activity that sooner or later does not have its public relations aspect.

"There is nothing mysterious about building and maintaining a good reputation. It requires the use of honest and efficient business practices and operating methods . . . The same principles that govern our individual relations in a community also govern those of our company."

Article in the February issue of Pure Oil News, magazine of Pure Oil Co.

New economies planned

"There's not much we as a company can do about oversupply. The oil industry as a whole is searching for new mass markets in an attempt to push up demand, but this is a long-range problem.

"The best we can do at the moment is to insure the health of our company by further reducing our costs of operation.

"The need to effect further economies has been conveyed to the managements of all our operating companies and new efforts will be launched immediately throughout our corporate family to search out more efficient ways of doing business."

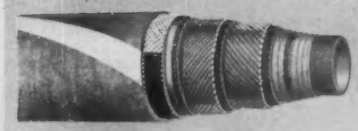
T. S. Peterson, president, Standard Oil Co. of California, in a letter to company employes in the January issue of Standard Oiler, company magazine.

Holding the line

"High production costs resulting from the inflationary wage-price spiral have severely weakened the world-wide competitive position of many American goods.

"This is reflected in alarming increases of imports and decreases of exports during the past 2 years.

"This situation creates two serious conditions. It threatens the jobs and security of American workers in in-



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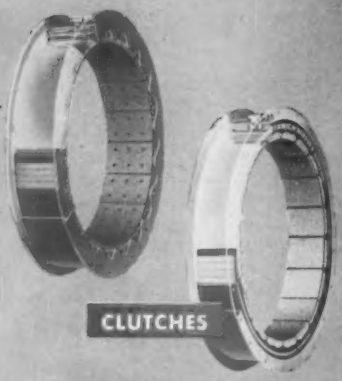
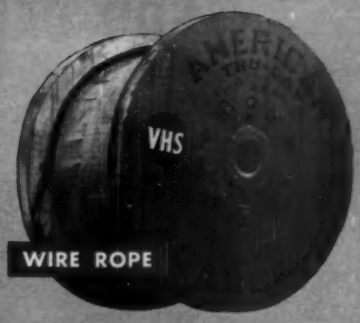
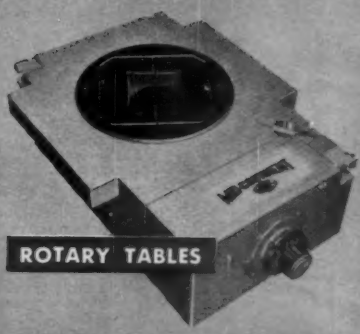


for the OIL INDUSTRY



Here you see just a few of the thousands of items of dependable, top quality drilling supplies and equipment available at Mid-Continent Supply Co. The "supermarket" for the oil industry has everything you need to make the job of drilling for oil—as well as the production and processing of oil—easier and more profitable. Operating out of these stores are skilled men, on call twenty-four hours a day, to render efficient service and offer technical assistance to the men in the field. From the Arctic to the Antarctic, the familiar Mid-Continent neon derrick is a symbol of sure service . . . sure supply . . . around the clock.



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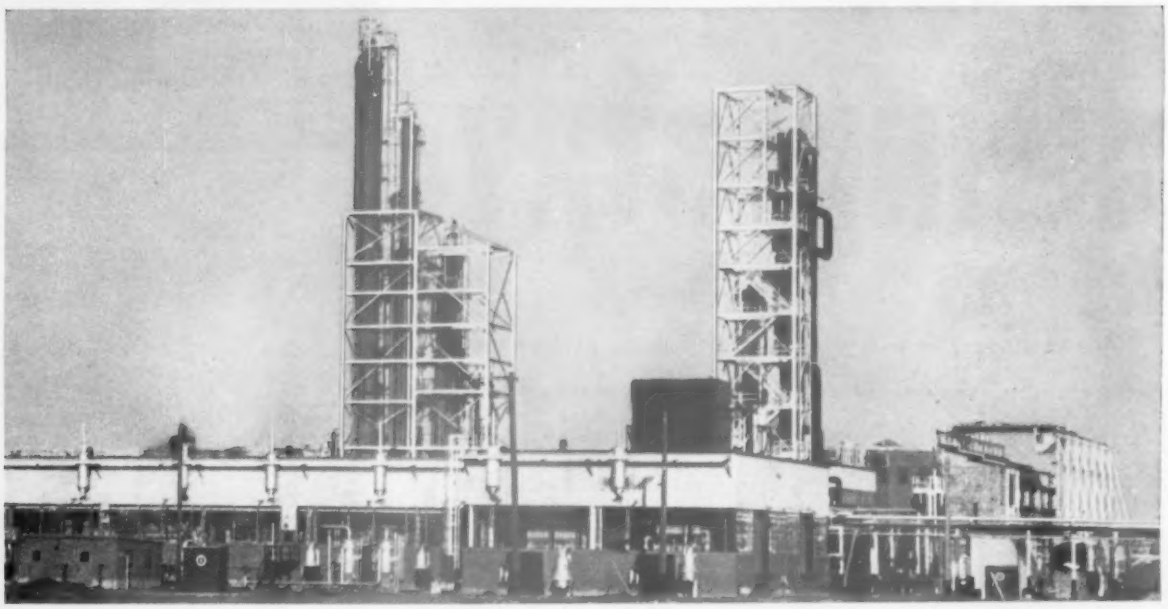
ETHYLENE PLANT EXPANSION ON STREAM FOR CANADIAN INDUSTRIES LIMITED

Lummus Designs and Engineers 85% Expansion of Ethylene Plant at Edmonton, Alberta, Canada



Expansion of C-I-L's ethylene facilities at Edmonton, Alberta, Canada, is completed and the plant now has a capacity of 46 million lbs. per year of high purity ethylene. The entire output of this unit is used by C-I-L to manufacture polyethylene.

Lummus designed and engineered the expansion of the existing cracking facilities, built in 1953, for the increased production of ethylene, and the ethane recovery unit for extracting ethane from natural gas.

As originally designed, the plant recovered ethylene from the cracking heater effluent and ethane from natural gas by oil absorption. In the expanded plant additional capacity is obtained by withdrawing the natural gas portion and increasing the heater effluent.

The new low temperature ethane recovery plant has a demethanization unit which utilizes ethylene refrigeration to temperatures as low as −145°F. At C-I-L's request sufficient capacity has been designed into this unit to permit another expansion step in the future.

Up-to-date equipment was employed to ensure economical and efficient operation. Special efforts were made, wherever possible, to incorporate existing equipment into the expanded plant.

In addition to the C-I-L expansion project, Lummus has designed 13 complete ethylene plants, with a combined total capacity of over one billion pounds per year.

Over 800 plants have been designed, engineered and constructed by Lummus for the process industry throughout the world in the last fifty years. Why not discuss your next project with a Lummus representative?

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dustries which cannot compete with lower foreign labor costs. Coupled with military and economic aid and heavy investment in other countries, it is causing a mass migration of American dollars.

"It is clear that ways must be found to hold down our domestic costs and stop further inflation. One way you can do this is to lower costs by improving efficiency in your own work. You can help give the new Congress courage to hold down spending by asking your senators and representatives to strongly oppose all legislation which contributes to inflation."

K. S. Adams, chairman, Phillips Petroleum Co., in an article in the February issue of Philnews, company magazine.

Depletion critics answered

"If the depletion provision were excessive, it would be expected that earnings in the oil industry would be excessive. The reverse is true.

"Published reports show that the rate of return for U. S. oil companies in recent years has averaged less than 10% as compared with an average of 12% for all manufacturing industries.

"Even college professors, who have opposed depletion, recognize that this tax provision means lower prices for oil and gas. For example, Dean Edward S. Mason of Harvard has stated that the effect of depletion is 'to expand investment and output—thus bringing down mineral prices'."

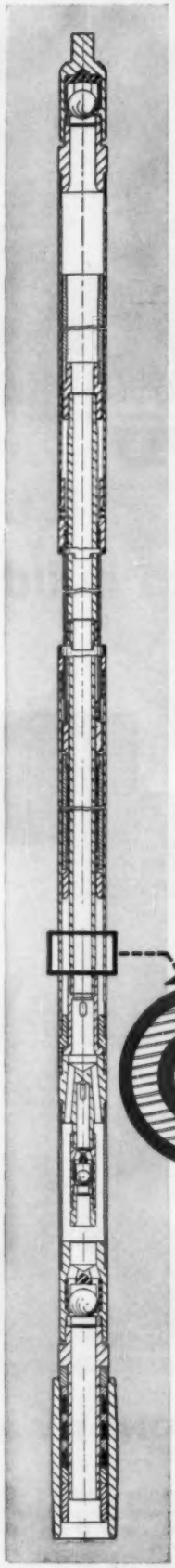
Minor S. Jameson, Jr., executive vice president, Independent Petroleum Association of America, in a letter objecting to an editorial in the Washington Post.

Coal seeks regulation

"The coal industry is striving more strenuously than ever before to have the federal Government impose 'end use' controls on oil and natural gas to eliminate these two fuels as competitors with coal in certain markets.

"Motivating this effort is reduction in coal's share of the American energy market from 70% in 1926 to less than 30% in 1959. Coal is striving, under the pretense of advocating a national fuels policy, to gain in Congress what it could not win in the market place.

"Coal's spokesmen contend that a national fuels policy is imperative to 'insure an adequate energy supply for our nation.' The preamble of a coal-supported resolution creating a joint committee of Congress to determine a national fuels policy declares that 'our national reserves of fuel and energy are in varying degrees limited, and in



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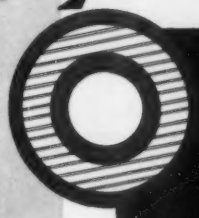
Insert Rod Plunger Pump

This particular design of Pacific's Type "D" Insert Rod Pump is one of the many tried, and is the direct result of engineering proved by actual field tests and operation. Over a period of years this pump was developed so that it could be removed on the rods for servicing ... yet produce at capacities equal to or greater than a Tubing Liner Pump. Many problems were encountered, but for each a satisfactory solution was found. The result is a most efficient and trouble free insert rod pump for handling large capacities.

The Type "D" Insert Rod Pump consists basically of two R. W. pumps in tandem. The upper pump is a Traveling Barrel Pump. The lower pump is a Traveling Plunger Pump.

WRITE FOR BULLETIN 204



Vertical cross sectional view of lower pump displacement chamber showing area which is between Inner Plunger Tube and Precision Tube. This area represents approximately 60% of the upper pump. Both pumps load on the up stroke and discharge on the down stroke.

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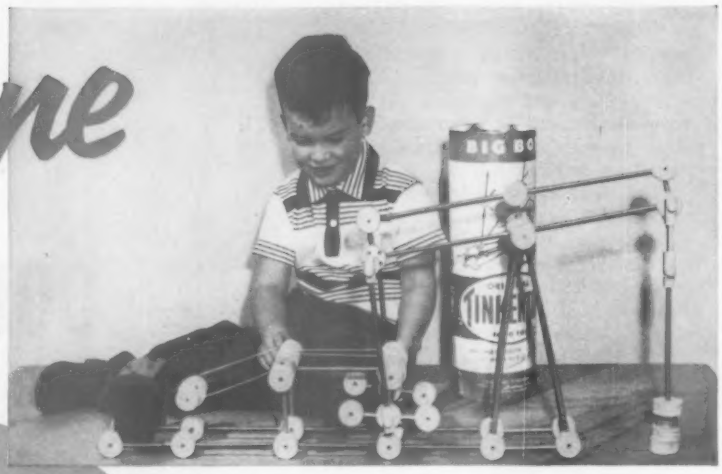

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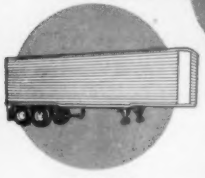
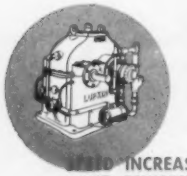


TRAILERS



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some areas we are in danger of approaching those limits.'

"Since the coal industry frequently has proclaimed that its reserves are sufficient to meet the nation's fuel needs for 1,000 years, the reference to fuels 'in danger of approaching their limit' can only refer to oil and natural gas.

"Needless to say, the whole case, pitched on that basis, is grounded on a false, or certainly highly questionable, premise.

"For some 40 years the country has heard dire predictions that it was running out of oil, yet domestic reserves are higher now than they ever have been.

"President Frank M. Porter at the last annual meeting of the American Petroleum Institute, characterized this coal proposal as a counsel of: 'If you can't lick 'em, ask the Government to regulate 'em.' "

Article in the winter issue of Our Sun, magazine of Sun Oil Co.

Letters to They Say should be addressed to The Editor, The Oil and Gas Journal, Box 1260, Tulsa, Okla.

CALENDAR

FEBRUARY

24-25 Wisconsin Petroleum Association annual convention and exhibit, Schroeder Hotel, Milwaukee.

24-25 Oklahoma State University, technical conference on natural gas engineering, Stillwater, Okla.

25 American Chemical Society, Delaware Valley region petroleum symposium, Philadelphia.

24-26 National Association of Corrosion Engineers, Tulsa section, eleventh annual corrosion short course, Mayo Hotel, Tulsa.

26 Natural Gasoline Association of America, Permian Basin regional meeting. Lincoln Hotel, Odessa, Tex.

26 Ohio Oil and Gas Association, winter meeting, Deshler-Hilton Hotel, Columbus, Ohio.

MARCH

2-3 University of Oklahoma, gas conditioning conference, Oklahoma Memorial Union Building, Norman.

2-4 American Petroleum Institute, Division of Production, southwestern district meeting, Statler-Hilton Hotel, Dallas.

3-4 American Gas Association, Pacific Coast Gas Association, joint public relations conference, Biltmore Hotel, Santa Barbara, Calif.

4 Southern Gas Association, transmission management conference, Jung Hotel, New Orleans.

6-9 American Society of Mechanical Engineers, gas turbine power and hydraulic conference, Rice Hotel, Houston.

7 Canadian Petroleum Association, annual general meeting, Hotel Palliser, Calgary.

7-8 University of Florida, annual heat

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SAND SEALED-OFF ROD PUMPS
Figs. 600, 800, 900

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- Sand deposited in blind cage, discharged every stroke
- Plunger bottom sealed to prevent slippage
- Fits any API seating device; use adapter for other types
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- Removes paraffin ahead of pump
- Allows pump to pull freely

Fig. 201A

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John & Paul Pump & Supply, Gladewater, Texas
Jack Yates Pipe & Supply Co., Gladewater, Texas
Midway Pipe & Supply Co., Greggton, Texas
W-B Pump & Supply Co., Pampa, Texas
B-H Pump Service, Selman City, Texas
Happy Co., Salem, Illinois

Thompson
PUMP COMPANY
Drawer 591 — Okmulgee, Oklahoma

The Colmonoy Spraywelder applying Colmonoy No. 6 alloy to oil well safety valve part

Colmonoy Hard-Surfaced Oil Field Parts Last Longer

Here are two success stories involving fast-wearing oil field equipment. In both cases longer part life was gained by using Colmonoy No. 6. This nickel-base alloy was applied with the Spraywelder, making smooth, welded overlays that resist abrasion and corrosion, have a low coefficient of friction, and do not gall.

Item 1: Oil Well Safety Valves

Safety valves placed down in the tubing strings of underwater oil wells *must* function if the string is broken. One valve manufacturer depends on Colmonoy No. 6 to provide long-wearing, non-galling hard surfaces in the sliding contact areas and on ball seats. Photo shows hard-surfaced areas.

Item 2: Sucker Rod Couplings

Sucker rod couplings working in hydrogen sulfide, salt water, and sand last 6 to 10 times longer when entirely hard-surfaced with Colmonoy No. 6. A west coast shop is doing this for less than one dollar a coupling. Where corrosion is not a problem, only banding at each end need be done.

Item 3: This success story hasn't been written yet. It involves your problem part. Tell us about it. Ask for the Spraywelder Catalog and Hard-Surfacing Manual No. 79.

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transfer symposium, Engineering and Industries Building, Gainesville, Fla.

10 Petroleum Equipment Suppliers Association, northern Mid-Continent district meeting, Tulsa.

11 American Institute of Chemical Engineers, Sabine area section; American Chemical Society, Texas-Louisiana Gulf section, seventh annual joint technical meeting, Lamar State College of Technology, Beaumont, Tex.

14-18 National Association of Corrosion Engineers, sixteenth annual meeting, Memorial Auditorium, Dallas.

16 Petroleum Equipment Suppliers Association, eastern district membership meeting, Duquesne Club, Pittsburgh.

16-18 American Petroleum Institute, Division of Production, southern district meeting, Hilton Hotel, San Antonio.

18 Natural Gasoline Association of America, Oklahoma regional meeting, Biltmore Hotel, Oklahoma City.

21-23 Midwest Gas Association, annual meeting, Hotel St. Paul, St. Paul.

21 University of Texas, school of gas technology, sixth semi-annual term, Kilgore College, Kilgore. Term ends April 29.

23 Petroleum Equipment Suppliers Association, Pacific district annual membership meeting, Ambassador Hotel, Los Angeles.

24-25 New England Gas Association, annual meeting, Hotel Statler-Hilton, Boston.

25-26 North Texas Oil and Gas Association, thirtieth annual meeting, Kemp Hotel, Wichita Falls, Tex.

28 University of Texas, American Petroleum Institute Division of Transportation, school of pipeline technology, eighth semi-annual term, Lee College, Baytown, Tex. Term ends May 6.

28 University of Texas, American Petroleum Institute Division of Production, institute on automatic production controls, first term, Odessa College, Odessa, Tex. Term ends May 6.

29 Petroleum Equipment Suppliers Association, Gulf Coast district membership meeting, Shamrock Hilton Hotel, Houston.

28-30 Western Petroleum Refiners Association forty-eighth annual meeting, Hilton Hotel, San Antonio, Tex.

29-31 American Power Conference, annual meeting, Sherman Hotel, Chicago.

30-Apr. 1 American Petroleum Institute, Division of Production, Mid-Continent district meeting, Broadview Hotel, Wichita.

APRIL

3-8 Engineers Joint Council, sixth nuclear congress, New York.

4-7 Oil Heat Institute of America, annual convention, Park-Sheraton Hotel, New York.

4-7 National oil heat and air-conditioning exposition, Coliseum, New York.

5 Petroleum Equipment Suppliers Association, southern mid-continent district membership meeting, Statler Hilton Hotel, Dallas.

5-6 University of Kansas, eighth annual gas compressor institute, National Guard Armory, Liberal, Kans.

5-7 Instrument Society of America, national chemical and petroleum instrumentation symposium, Rochester, N. Y.

7-8 Rocky Mountain Oil and Gas Association, midyear meeting, Newhouse Hotel, Salt Lake City.

8 Chemical Institute of Canada, rub-

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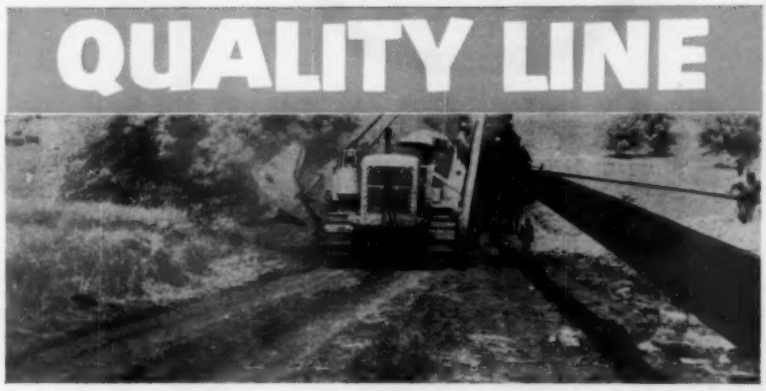

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Hand Chain • Electric

ber chemistry division, annual meeting, Kitchener, Ont.

12-14 Petroleum Industry Electrical Association, Petroleum Electric Supply Association, conference and exhibition, Municipal Auditorium, Kansas City.

15-16 Society of Economic Paleontologists and Mineralogists, Pacific section, annual spring field trip, Panoche Hills, San Joaquin Valley, California, and evening meeting, The Hacienda, Fresno, Calif.

19-21 University of Oklahoma, College of Engineering, southwestern gas measurement short course, north campus, University of Oklahoma, Norman.

20 Chemical Institute of Canada, joint meeting, Quebec rubber and plastics group and Montreal section, Queen's Hotel, Montreal.

20-22 American Petroleum Institute, Division of Production, Rocky Mountain district meeting, Gladstone, Henning, and Townsend hotels, Casper, Wyo.

20-22 National Petroleum Association, semiannual meeting, Hotel Cleveland, Cleveland.

20-22 Oklahoma State University, technical conference on heat transfer, Stillwater, Okla.

21-22 Texas Technological College, seventh annual West Texas oil lifting short course, Lubbock, Tex.

21-23 Society of Economic Paleontologists and Mineralogists, Permian basin section annual meeting and field trip, Abilene, Tex.

24-26 Independent Petroleum Association of America, midyear meeting, Denver Hilton Hotel, Denver.

25-26 American Society of Mechanical Engineers, maintenance and plant engineering conference, Chase-Park Plaza Hotel, St. Louis.

25-27 Southern Gas Association, convention, Buccaneer and Galvez hotels, Galveston.

25-28 American Association of Petroleum Geologists, Society of Economic Paleontologists and Mineralogists annual meeting, Chalfonte-Haddon Hall, Atlantic City, N. J.

25-29 American Welding Society, annual meeting and welding exposition, Los Angeles.

27-29 Natural Gasoline Association of America, annual convention, Rice Hotel, Houston.

28-29 American Petroleum Institute, Division of Transportation, pipeline conference, Mayo Hotel, Tulsa.

28-29 Pacific Coast Gas Association, distribution conference, Benson Hotel, Portland.

MAY

1-4 American Petroleum Institute, Division of Transportation, tanker conference, Seaview Country Club, Absecon, N. J.

2-3 Society of Petroleum Engineers of AIME, North Texas section, fourth biennial secondary recovery symposium, Wichita Falls, Tex.

5-6 American Institute of Mining, Metallurgical and Petroleum Engineers, annual joint meeting of Rocky Mountain petroleum sections, Calgary.

5-6 Canadian Institute of Mining and Metallurgy, annual technical meeting of petroleum and natural gas division, Palliser Hotel, Calgary.

9-12 American Petroleum Institute, Division of Refining, midyear meeting, Statler and Sheraton-Cadillac hotels, Detroit.

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50 years ago

February 20, 1910

Prairie Oil & Gas Co. pays $2,000,000 for Oklahoma holdings of Jennings Brothers in Mid-Continent's largest oil and gas deal. Purchase involves more than 14,000 acres with 414 wells scattered over the Cherokee shallow sand, Hogshooter, Bartlesville, and Osage districts, and twelve 55,000-bbl. and three 37,500-bbl. oil tanks.

Cattlemen in Oklahoma's Osage country saved their animals from freezing during last week's severe blizzard by tapping pipelines across their ranches and igniting the escaping gas. Towns along the lines suffered from gas shortages.

The British Admiralty announces its navy will replace coal with oil for fuel on all its ships. Order placed for more than 10,000,000 gal. of fuel oil as a starter.

St. Louis industrialists touring Oklahoma fields to check available gas supply for proposed pipeline to the Missouri City are assured state has developed reserves capable of producing 1,500 M.M.c.f.d.

25 years ago

February 21, 1935

First important production from Cretaceous-Navarro sands in South Texas is opened by Amerada Petroleum Corp. in a discovery (Pearsall field) 5 miles southwest of Pearsall, in Frio County. Its 3 Halff & Oppenheimer flows 280 bbl. of oil per day from 3,900-ft. pay.

Dallas conference of governors and official representatives of nine oil-producing states unanimously adopts interstate compact to conserve oil and gas. States represented are Oklahoma, Kansas, California, Texas, New Mexico, Arkansas, Michigan, Illinois, and Colorado. Legislatures asked to ratify their action.

10 years ago

February 23, 1950

Texas Railroad Commission junks MER oil proration system in surprise move. Flush-production fields such as Scurry expected to suffer under impending new plans to be revealed later. East Texas and "poorer" fields may gain.

Britain's delayed curb on sterling-area sales of dollar fuel oil and gasoline goes into effect. U. S. officials hopeful for easement of terms as negotiations continue.

Spectacular expansion and linking of reef-trend fields in Scurry and Borden counties, West Central Texas, make this the country's third-largest oil-producing area. Daily output passes 52,000 bbl. from 450 wells. More than 180 wells drilling.

JOURNALLY SPEAKING

Witness for the Prosecution

DID YOU EVER play a bridge hand where your opponents held all the trumps, face cards, and distribution, and all you could do was see them pick up one trick after another for a grand slam?

If so, you know how the Government attorneys must have felt during the Tulsa trial of 29 major oil companies on charges of conspiring to raise prices.

With sickening (for them) regularity they saw their best bits of evidence knocked into a cocked hat on cross-examination.

They would introduce a document from a company's files and read the court a sentence or two that they said proved their point. Then that company's attorney would read another passage from the same document that completely demolished the argument.

Or they would put an oil-company man on the stand and make him admit that he telephoned somebody in a competing company at about the time that both companies raised their crude-oil postings. But then defense counsel would take over the questioning and ask him the topic of the conversation. And in every instance the witness was able to show that it concerned some legitimate routine business matter—or sometimes was just a social call—and had nothing whatever to do with either company's price policies.

It was amusing how every witness for the prosecution drove another nail in the coffin of the Government's case.

It was also puzzling. We have seen whodunit movies where the witness for the prosecution threw a trial into a tail spin by revealing some totally unexpected evidence on crossexamination. But we didn't think it happened very often in actual court cases.

We asked some of the defense counsel why the prosecution didn't save itself such embarrassment by finding out in advance what its own witnesses were likely to say.

"Oh they knew," was the reply. "In our briefs and in the pretrial conferences we told the Government counsel exactly what we were going to do and what the various industry witnesses were going to testify."

"But why did they think they could get by with it? Did they think their witnesses wouldn't be crossexamined? Or that you would let them read a sentence from a document out of context without calling their hand?"

We never got any answer to that one, except that one of the Government attorneys said he had known of lawsuits being won that way.

We understand that some of the industry men who were called—or who thought they might be called—as witnesses for the prosecution were scared to death at the prospect.

But they needn't have been. Every one we saw on the stand acted as though he had a perfectly clear conscience and nothing to hide. They even seemed to enjoy knocking the props out from under the Government's inferences and innuendos. Maybe the experience of this trial will stiffen the industry's backbone to talk back vigorously the next time anybody unjustly accuses it of doing something improper.

But there's one thing that oil men probably won't be able to do, and that is to say or write things that can never possibly be misinterpreted. Quite a few observers of the trial commented that hereafter oil men should be so careful what they write—even on their telephone note pads—that they won't have to be asked to explain it.

That's asking too much. Take it from us as a professional writer. If we never wrote anything that somebody didn't take the wrong way we would be the world's greatest.

As it is, we sweat and strain and rewrite and polish to perfect a masterpiece of clarity. But as soon as it comes out in print somebody always deflates us by asking "What did you mean by that?"

Nope, there's little hope that oil men will be able to avoid being misunderstood.

The best they can do is to so live that they can explain their positions and their actions satisfactorily whenever they are called as witness for the prosecution.

—Henry D. Ralph.

▶ ▶ ▶ Editorial

Oil is acquitted—

but the Government stands indicted

THE SHABBIEST antitrust case in the 70-year history of the Sherman Act has ended in a clean-cut vindication of the oil industry.

The 29 major oil companies were completely exonerated of doing anything illegal, improper, or even suspicious in raising prices during the shortage caused by the Suez Canal closing in 1956-57.

The companies didn't even have to present their side of the case other than through filing briefs and crossexamining witnesses for the prosecution. The Government's own evidence convinced the judge—as it would have convinced any lay observer—that the pattern of price actions was the result of competition rather than collusion and was brought about by independent business judgments and not by conformance to a prearranged plot.

The Government's case was so flimsy as to be ridiculous.

Starting with a hypothesis of guilt, it spun a gossamer web of suspicion, inference, and assumption. It deliberately ignored facts in preference for suppositions. To get the barest suggestion of a conspiracy plot it used unrelated incidents to build a house of cards held together by sheer fantasy. One puff of realism demolished it completely.

The decision is a legal victory for all industry. It should be a precedent for future holdings that competitive price increases are not illegal just because they are parallel or concurrent.

It is a moral victory for the oil industry, which for years has been the target of political abuse and indiscriminate allegations of monopolistic practices. Too often the industry has taken it lying down, but this time it stood up and fought. Its unqualified victory strengthens its morale, and certainly should improve the public's opinion of it.

For the judge went further than simply dismissing the case. He could have said that the Government failed to prove guilt beyond a reasonable doubt, which might have left the inference that the companies beat the rap on a technicality or by cleverly covering their tracks. He said he was personally convinced that there was no concerted plan, and that each company's price increase was based on its individual competitive position and was what could normally be expected of sound business management.

ALL QUESTIONS about the competitive nature of crude oil and gasoline prices, and the conduct and integrity of oil-company executives, have been put to rest by this trial.

But there remain some serious questions about the conduct and integrity of the Government. They concern the sincerity and motives of administration officials of cabinet or policy-making rank.

1. Why was this case brought?

Routine scrutiny of all general price increases is perhaps proper. But in this instance the head of the Antitrust Division prejudged the case and told a congressional committee he would bring criminal proceedings. An FBI dragnet and a 15-month grand-jury investigation produced what the Department of Justice admitted was no more than circumstantial evidence.

The investigation also revealed to the Government the companies' full explanation of everything it considered suspicious and their complete rebuttal case. Yet the Government insisted on a trial with full knowledge of the defense evidence and arguments.

In the face of this, why were the taxpayers and the industry put to the tremendous expense and burden of this trial?

It was a case of pure, unabashed politics. The administration made a calculated judgment that it could win votes for itself by being vindictively antibusiness, by persecuting any industry that dared to act independently, and by perpetuating a historic vendetta against the oil industry.

2. Why was guilt assumed?

What has happened to our basic concept of justice that a man is considered innocent until proved guilty?

The Government's entire case rested on the assumption that the oil industry would violate the law at the slightest opportunity. It was built on the flimsy syllogism that (1) prices went up; (2) the companies had communications with each other; therefore (3) they must have been conspiring to raise the price by illegal collusion.

With a persistence that strained credulity, Government counsel rejected all other explanations of the companies' price actions, conferences, statements, and telephone calls, no matter how reasonable these explanations seemed to anyone with even a rudimentary knowledge of how the oil business operates. Throughout the trial they avoided obvious explanations and strained for tortured conjectures.

The chief prosecutor told the court he could see no explanation for the price increases other than a prearranged conspiracy. This indicates that the Government is blind to the facts of business life and is predisposed to assume an antitrust violation in the most innocent and normal business transaction.

This is a completely improper and immoral posture for the Government of the United States. Industry cannot prosper and progress in such an atmosphere of suspicion and threat. It belies the word "justice" in the title of the department in charge.

3. Is the administration trying to rewrite the law?

In this case the Government appeared to take the position that it is illegal:

- To raise prices regardless of costs, competition, or any other justification.
- To have uniform, or even approximately uniform, prices for a homogeneous commodity of more-or-less common specifications and available from many sources.
- To make a public statement that prices should be raised to cover increasing costs.
- To seek or seize an opportunity to raise prices.
- To have a desire to increase profits.
- To communicate with competitors socially or in the normal course of buying and selling or conducting joint ventures.
- For a parent corporation to acquiesce in or even have advance knowledge of a price increase by a subsidiary. This surprising doctrine would upset the pattern of business operations in every industry in the land. Yet Government counsel solemnly assured the court that such is the official and studied position of the Department of Justice.

Such contentions, if upheld by the courts, would radically revise our whole body of law regarding competition and business conduct, would eliminate the kind of free enterprise and managerial discretion upon which our economic growth has been built, and would impose an alien system of government upon this country.

If this is really the administration's intention, it is time that the American people understand it, and time for Congress to call a halt to this usurpation of its legislative functions.

4. Who's in charge here, anyway?

The nation should examine the backgrounds and philosophies of the men entrusted with the administration of its laws concerning business practices and economic growth.

Was this patently weak and unsupportable allegation of an oil conspiracy pursued to the bitter end because the top officials are abysmally ignorant of ordinary and normal business methods and activities?

Or do they have a studied plan to expand the scope and interpretation of the Sherman Act far beyond its original intent and established application?

Or could it be a distrust and hatred of private business generally and the oil business particularly?

Men so motivated are not proper to occupy positions where fair treatment and impartial judgment are required, and particularly not in charge of a criminal statute governing business conduct.

THE TULSA TRIAL was a gratifying vindication of the oil industry. It cost the industry many millions of dollars, but now the industry should spend perhaps as much in letting the public know what happened to it and how shabbily it was treated by its Government. But that's not all.

The case was a sorry chapter in administrative procedure. The Government sank to a new low in persecution of legitimate business. Now Congress should investigate the investigators. There should be an open inquiry into whether it is the deliberate policy of the administration to persecute and smear the industrial community, and whether such a policy is the genuine desire of the American people.

Business cannot be conducted in a perpetual climate of suspicion, persecution, threat, and the hypothesis of guilt. The Tulsa case should be the turning point toward a more fair and realistic application of the antitrust laws.

The Government went into this case on a suspicion that the oil industry was guilty of improper conduct. It came out of the case under a heavy cloud of suspicion that its own conduct is highly improper.

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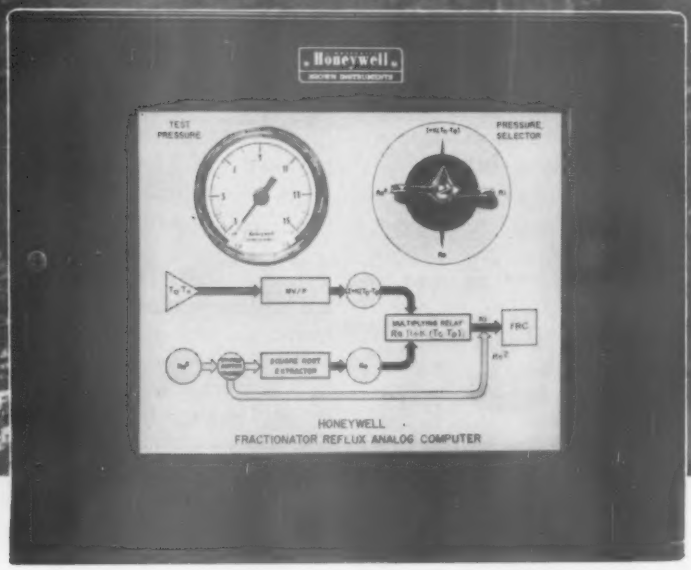

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- Only four simple, easily accessible process connections required to put the unit in operation.
- Chassis pulls out for front-of-case servicing, simplifying adjustment and maintenance for your instrument technicians.

COMPONENTS

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- Constant voltage supply
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- Provide check of all pneumatic pressures within the computer for simplified trouble shooting.

By-pass switch

- Permits switching from *FRAC* control to conventional external reflux flow control.

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*FRAC** Controller

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- **Tamper-proof design**

This new Honeywell control system immediately adjusts column operation to the effects of ambient temperature on overhead product condenser and external reflux. It continuously computes internal reflux flow, to maintain the most efficient, economical fractionating tower operation.

The new method, originally developed and licensed by Phillips Petroleum Company, utilizes a simple Honeywell analog computer employing standard Honeywell electric and pneumatic instrument components.

By correcting instantly for temperature deviation, the new control system offers the following economies.

- Less reboiler heat is required, because large surges of internal reflux that would lower temperature are eliminated.
- Reduction in off-specification product minimizes re-runs and the need for intermediate storage.
- Closer control permits fractionator to operate closer to the flooding point.

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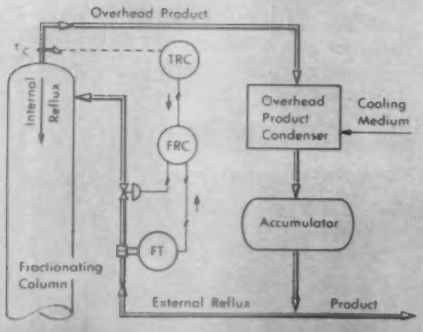
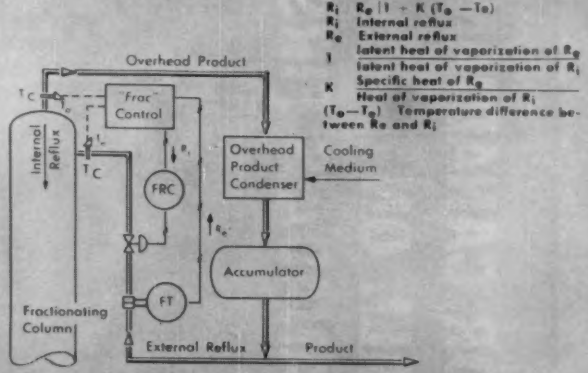


PROBLEM with existing fractionator control systems—Column is upset when temperature of external reflux is indirectly affected by changes in atmospheric conditions or in the temperature of the cooling medium to the condenser. Result: off-spec product, wasted reboiler heat, lower fractionator capacity.



SOLUTION: *FRAC* Controller (1) measures external reflux flow rate (R_o) and the temperature difference between the overhead product (T_o) and the external reflux (T_e); (2) computes internal reflux flow rate (R_i); and (3) holds it constant by adjusting external reflux flow rate for efficient fractionator operation.

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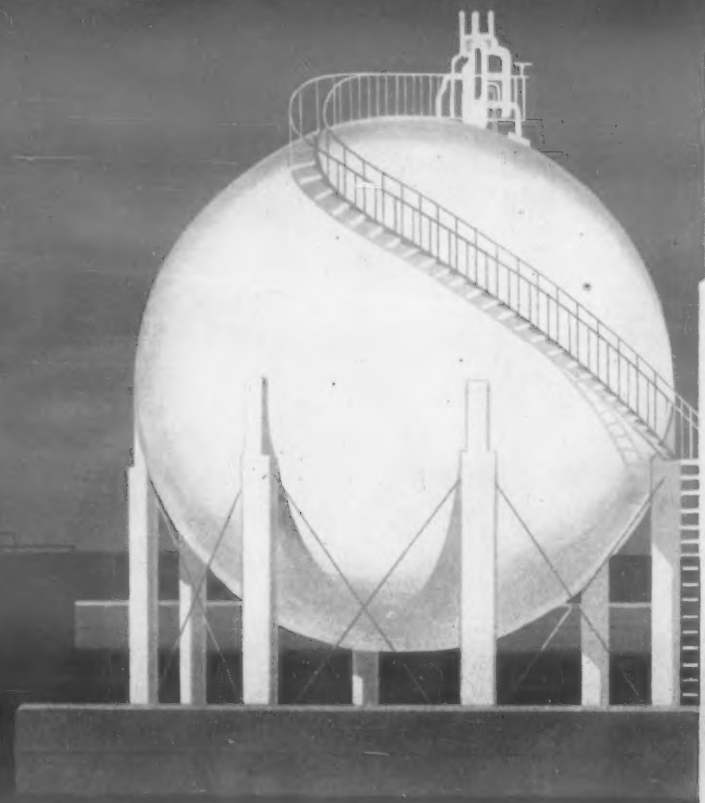

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Some Lessons Taught by Tulsa Case

• It may deter the Justice Department from filing future charges on little evidence, lawyers think. It also suggests better ways of announcing price changes and of writing memos. But, in brief, it permits business as usual.

OIL MEN, surveying their decisive victory last week against federal charges of antitrust conspiracy, spotted a few legal landmarks and some practical results arising from the Tulsa case.

U. S. District Judge Royce H. Savage granted motions of acquittal for the 29 defendant oil companies made after the Government rested its case. He ruled the Government failed to make a prima facie case of conspiracy to fix prices.

But Judge Savage went beyond that and declared he was convinced by the evidence that the oil companies were not guilty and need not conduct a formal defense against the charges.

The ruling ended a political, economic, and legal wrangle that has involved the oil industry since the Suez crisis in 1956-57. Since it was a criminal case, the Government can not appeal.

Legal landmarks . . . Oil-company lawyers feel the case may provide some important precedents.

They believe the case has:

. . . Provided a new way to handle protracted litigation.

. . . Halted further extensions by the Government of the scope of the present antitrust law.

. . . Showed absolute frailty of trial by innuendo.

. . . Provided a good ruling on the question of conspiracy among a family group of companies.

Creeping power . . . Lawyers also believe the decision may force the Justice Department to adopt new strategy in antitrust prosecution.

They have noted in recent cases an effort by the Government to rely on remotely circumstantial evidence from which to draw inferences of antitrust guilt. It has become almost a trial by innuendo.

Several experienced antitrust lawyers in the defense ranks say the oil decision, coupled with the recent Salk vaccine decision in the drug industry, may have turned the tide against this type of trial. They believe in the future the Government will not come to trial until it has more creditable and more reliable evidence against a group of companies within an industry.

Joseph E. McDowell
. . . sees price-regulation threat.

It took no expert to conclude that had the Government won its case on the type of evidence presented, the oil industry would have found it nearly impossible ever to raise crude prices again.

The Government presented an amorphous mass of data, including public statements of oil executives, intracompany memoranda, telephone calls between crude buyers, and crystal-gazing reports by company economists. From this mass the prosecution tried to infer the 29 companies conspired to raise crude and product prices at the height of the Suez Canal crisis.

Oil-company lawyers felt that the government strategy represented an extension of the original scope of antitrust legislation and would put the stamp of illegality on all price increases. From this viewpoint, Judge Savage's decision may become a powerful barrier to further government attempts to extend the law.

Family trouble . . . Judge Savage's decision will be very important in one area of the law involving parent companies and their subsidiaries.

On this question, the Government contended that when a parent company and a subsidiary confer on price increases, this constitutes a per se violation of the antitrust law. Such an interpretation put such combines as Jersey Standard, Cities Service, Socony Mobil, Ohio Standard, and Indiana Standard on a ticklish spot.

If such an interpretation had prevailed, these companies could never decide on prices under their present corporate setup. The result might be a rash of mergers to get everyone under one corporate roof where they could discuss and act on prices.

There are very few clear-cut court decisions on this question, and Judge Savage's ruling provides a precedent on at least one aspect of the issue. He ruled that when a parent company merely approves plans of a subsidiary to increase its prices, an illegal agreement has not been made.

Politics . . . The oil-industry victory may have a political side effect in this election year.

Many oil men feel that the entire antitrust case against them was politically inspired and is part of a general plan in the liberal wing of the Republican party to erase a big-business tag in the minds of voters.

Protests of consumer-state con-

The judge's ruling

EXCERPTS from ruling of U. S. District Judge Royce Savage on main issues of the Tulsa case:

Economic background

"Insofar as the conspiracy alleged in the indictment is concerned it seems to me that the Government's position is based upon the first premise that economic conditions existing in December 1956 and January 1957 were not exerting any pressure for a general increase in crude-oil prices.

"It is the Government's contention that crude stocks and gasoline stocks were not in short supply; that the export demand brought about by the closure of the Suez Canal could not then have been expected to result in any substantial reduction in crude stocks, and that, as a necessary consequence, there could not have been a general crude price increase, absent an agreement upon the part of the defendant companies to act in concert to bring about the increase.

"I don't agree with that first premise.

"And then in addition, I think there are other considerations that must be taken into account . . . The evidence discloses that there had been an increase in cost in connection with the exploration for and the production of oil . . . That alone was an important factor suggesting justification for an increase in crude prices at a time when there was perhaps excessive stocks on hand.

"But after the closure of the Suez Canal, the industry was confronted with an entirely different situation. I feel confident that there were many of the defendant companies that had given consideration to possible increases before that emergency arose."

The conspiracy

". . . Humble took the lead in announcing this price increase. And I don't believe we get a true picture of the situation by looking to the studies of the crude stocks collectively.

"Humble had an export demand in January of 5½ million barrels. They were in position to supply 1,200,000 of them, I believe, and 600,000 of that was oil carried over from the preceding month, which they had not been able to deliver because of tanker shortage. So certainly there was terrific, it seems to me, economic pressure on Humble to increase the price of crude oil.

"Now there isn't any evidence here in my judgment which would warrant a conclusion that Humble discussed this price increase with any person except the conversation that Mr. Baker had with Mr. Rathbone.

U. S. Dist. Judge Royce H. Savage

"Now it is true that Continental followed on the same day with its announcement, but the evidence discloses that Continental had been making a study of the economic situation for almost a year, or perhaps even longer. It was a continual thing, but Continental was looking for the opportune moment to increase the price of crude, and that, to me, does not suggest any unlawful action or any concerted action.

"So . . . others . . . followed suit—in each instance the evidence certainly warrants a conclusion that there was an economic justification for the move made. . ."

The evidence

"It is my judgment that the evidence in the case does not rise above the level of suspicion . . . I think I should go further and simply say that after giving consideration to all of this evidence, I have an absolute conviction personally that the defendants are not guilty of the charge made in this case.

Corporate family groups

". . . It is my view that the mere approval by a parent corporation of the price schedules and pricing policies inaugurated and fixed by the subsidiary corporation does not constitute a per se violation of the Sherman Act."

gressmen prompted the original grand-jury investigation of oil prices. Had the oil companies been convicted on the type of evidence presented, the Justice Department would have had an easy-to-use political weapon against other industries.

Some practical results . . . The trial showed that oil men need to learn the art of memo writing.

One lawyer gave this advice after the trial: Be careful in writing even the most innocent memo so that the language is clear, truthful, and says what is meant. Also consider how it might sound if used against the company in court.

So often in the Tulsa trial the Government used a memo trying to prove conspiracy from the general and vague wording used by a company executive. The government inference usually was far afield from the writer's original intention, as shown by the defense.

The same rule of clarity and accuracy should extend to logs of daily activities, public statements of oil-company executives, and the annual reports, this lawyer warned.

A few company lawyers feel some changes should be made in the mechanics of announcing changes in crude-price postings. Some advocate that their companies first make a press release on the new postings, making them generally known to the public before any notice is sent to interested competitors in the oil industry.

Such a practice might remove any inference of collusion to be drawn

from the fact that competitors were notified before the change was publicly known.

For the most part, lawyers expect very few practices to be changed drastically by the court trial. After all, the oil companies won, and the business methods of the companies were not the whole issue.

The future . . . The oil-industry victory very well could give comfort to a movement in Congress to impose price regulations on big industries, such as oil.

This possibility was voiced by Joseph E. McDowell, chief government prosecutor. He recalled such a regulatory measure was considered on Capitol Hill last year. It was dropped when the Justice Department convinced the congressmen that the best course was to continue policing prices by antitrust suits.

But the Justice Department has lost two of its recent big antitrust suits, and this may convince a segment of Congress that the antitrust laws need strengthening or should be replaced by actual price-control laws.

McDowell also defended the Justice Department actions in the oil case. He said he felt the evidence was sufficient to bring the case to trial.

Speedy justice . . . The outstanding feature of the entire case was the speed and smoothness of the trial. It lasted only two calendar weeks. Lawyers had expected it to last as long as 4 months.

Behind this speed record lay much pretrial work by Judge Savage and attorneys for both sides. The government lawyers held meetings with representatives of each defendant to cull out the documents and agree on certain aspects of the evidence.

Judge Savage required the Government to supply a bill of particulars indicating more details on the nature of the conspiracy charge against the companies. The Government filed an extensive pretrial brief, and the oil companies filed defense briefs.

These months of pretrial work explain why the trial went so smoothly. Added to this were rules adopted in court providing automatic blanket objections and restraint from extensive argument. All these steps now provide courts the country over with a tried procedure for industry-wide antitrust litigation.

Back to work . . . While many company executives and lawyers pondered the lessons learned by the antitrust trial, one crude buyer tartly observed:

"Now we can get back to work. I've tried this case every day for 2 years. It's a relief to be rid of it."

watching WASHINGTON

Clyde La Motte

• A refinery strike is bad enough, but . . .

ONE OF THE TRICKY little grounders the Oil Import Appeals Board had to field during a recent hearing involved the quota situation for a company that had some of its plants hampered by strikes.

The problem was whether the company should have gotten a crude-import allocation for the next period based on what its refinery runs actually were in the base period or on what the runs would have been had it not been for the strikes.

When the Oil Import Administration considered the situation last December, it reached the conclusion that the rules left it no choice but to base quotas on actual runs.

The company—Standard Oil Co. (Ind.) in this case—therefore got a lower crude-import quota than it normally would have received.

Indiana Standard deemed this highly unfair, so it hastened to the appeals board in an effort to get its quota hiked.

The company figured it had suffered enough from the strikes without being punished further by the Government.

Also, it felt some added salt was being rubbed into its wounds in this respect: During the strikes at five of its plants in 1959, it had to buy products from other refineries. These purchases obviously tended to increase the refinery runs of the companies from which it was buying, thus qualifying them—Indiana Standard's competitors—for higher quotas during the upcoming period when Indiana Standard would be permitted to import less crude. And all because of the strikes.

Indiana Standard officials cited the board a specific example: During the strike they made an emergency purchase of 500,000 bbl. of gasoline from one particular company in the third quarter of 1959, thus presumably qualifying that company for an extra allocation of 76,000 bbl. over two allocation periods.

THE SITUATION could be even worse if OIA rules are held rigid on this point, Indiana Standard warned.

Suppose, they said, that all of a company's refineries were completely shut down by strikes during a 6-month allocation period. That would mean that for the next 6-month period the company would get no import quota at all, even though its plants were back on stream.

(It wouldn't get a quota, that is, unless the company was an "historical" importer and thus protected by the sliding-scale formula which gives such a company a minimum quota based on its historical imports record. Indiana Standard isn't one of these historical importers, so it doesn't have that protection.)

Thus, inadvertently, the OIA may have given the oil unions an extra club to use over the heads of some oil firms. For the union could not only make a company suffer during a strike but, by causing it to get a lower import quota for the next 6-month period, could cause the company an added loss even after the strike had ended.

THIS IS NOT just peanuts. In Indiana Standard's case, the company feels it should receive a hike of at least 1,259 bbl. daily in its crude quota to bring it to the total it would have obtained had it not been for the strikes.

Figuring 80 cents to $1 a barrel difference, the loss of that 1,259 bbl. daily in crude-import quotas would amount to something over $1,000 a day in added operational expenses for Indiana Standard's refineries. That, in 6 months, makes a tidy sum, indeed.

The appeals board members didn't commit themselves during the hearing, of course. But a bystander thought he detected a gleam of sympathy in their eyes.

Government May Take Control of Offshore Oil Production

• USGS is now studying conservation rules to govern offshore operations. It's not eager to take over, it says, but it will if it becomes dissatisfied with state-fixed allowables or if it inherits a lot of oil through the Supreme Court boundary ruling expected this spring. The idea worries oil men.

THE federal Government eventually may take over conservation controls, including proration of production, in federal offshore areas.

Such a possibility has been in the talking stage quietly now for more than a year, but it will move upstage next month.

A conference has been scheduled for March 3 between E. W. Henderson, oil and gas supervisor for the U. S. Geological Survey in the Gulf Coast region, and Ashton Mouton, conservation commissioner for Louisiana.

Their talks will be strictly preliminary but are essential because the Supreme Court is expected to hand down its decision before June settling the federal-state offshore boundary dispute.

Henderson disclosed last week the Government will adopt "some kind of procedure" for setting offshore allowables once the decision is handed down and the dividing line fixed.

Break for operators . . . The Government, Henderson said, wants to work with the state as far as possible in setting allowables.

In the past the Government has required operators who hold federal leases to conform with state regulations setting allowables.

Henderson emphasized that the Government will enter the negotiations with the state in a spirit of cooperation. He pointed out, however, that the Government is interested in giving offshore operators a better break in allowables because of the high cost of drilling and producing in water.

Offshore wells today have an allowable about one and one-third times that of comparable deep onshore wells, Henderson said. But this advantage is far less than it was in the early 1950's.

"The bonus now has been whittled down to 35% of what it was originally," Henderson said.

Scope of talks . . . The Mouton-Henderson talks will cover only offshore wells on federal property.

Henderson said the Government has no thought now of attempting to take over proration and regulation of onshore wells, either in Louisiana or elsewhere.

The Supreme Court is expected to decide whether state-controlled waters extend 3 miles or 3 leagues seaward.

The decision, however, may not be clear-cut or where the actual boundary line may be drawn because of differences of opinion on the location of the shoreline or coastline. For this reason, Henderson said, there may be a considerable period after the filing of the court decision before the state and federal Governments will know which areas are in which jurisdiction.

A joint federal-state committee currently is working on a project to set the Louisiana coastline, but its work will not be completed for months.

The difficult areas to map are in the Mississippi River delta and Atchafalaya Bay.

Pressures at work . . . Geological Survey officials in Washington say they hope to continue present policies.

The Government has been content to let the adjoining state handle the production proration task.

But these officials concede a situation may develop in which they would feel obligated to step into the proration picture.

Such a "situation" could arise, for example, if federal officials felt that state regulatory officials were discriminating against federal offshore production.

USGS officials are not unaware that pressures have built up in some instances between offshore and interior producers. The offshore producers feel that the extra cost and extra risk of offshore work entitles them to special proration consideration.

Meanwhile, some interior producers oppose this trend. They feel that the net result is to decrease their own allowables. The prospect that all allowables will continue to be held low in the foreseeable future simply adds to this tension.

Decision important . . . The issue probably will not reach a showdown, if it does at all, until after the Supreme Court hands down its decision.

Should the court rule in favor of the Gulf Coast states — extending state ownership 10.5 miles out from shore — there would be less likelihood that the federal Government would seek to control allowables in the area beyond this point because the production there has not reached any sizeable proportion.

But should the court restrict the states to a 3-mile boundary, thereby putting a much larger production area into the federal Government's hands, the Government might then decide to do its own prorating.

Some observers fear that a 3-mile limit would tend to cause producers within a state to encourage state regulatory officials to keep federal offshore allowables low. One part of such an argument is that the state itself would be financially foolish to encourage federal offshore production instead of encouraging production within the state — because the state gets revenue from the latter.

Obviously, this tug-of-war could become a political issue either at a state or federal level.

Up to state . . . As things stand now, USGS officials indicate they feel that any change will result only from state action.

That is, since they are content with the present method of letting the state set the offshore allowables, they would be inclined to act only as a result of some future action by a state regulatory body.

One other deterring factor to separate state-federal proration is this: Even after the Supreme Court makes its ruling on the offshore boundary, it may take years to determine the exact location of either a 3-mile or a 10.5-mile boundary.

As a result, an undecided zone lying between state and federal offshore areas may continue to exist for years. Since neither the state nor the Government would have clear-cut jurisdiction over this zone, it would be essential to have an agreement on conservation rules between state and federal regulatory agencies.

If a hassle does develop, it is quite likely that Congress will be called upon to pass legislation clearly specifying boundary lines and areas of authority.

Producer reaction . . . At least one producer, aware of the possibility, is dead set against any federal proration.

Officials of this major oppose the move because of:

. . . Possible discrepancies in regulations between offshore and onshore leases.

. . . Added clerical burden on company staffs to do the paper and legal work to conform to more regulations.

. . . Fear this would be an entering wedge for ultimate federal control of proration on federal lands onshore, especially on Indians lands in western states.

. . . Possible complications arising from reservoirs lying partly under public lands and partly under private acreage, from ratable take between fields, and from pipeline proration problems.

They consider it virtually certain that any federal proration offshore ultimately will lead onshore and set off a train of serious consequences.

The basic fear among oil men naturally is that any federal move to prorate offshore will be an opening wedge for more encroachments into the oil business.

The next step would be federal proration on public lands onshore. Some oil men who are aware of federal thinking on the offshore issue think this extension onshore would be inevitable.

Consider these possibilities: Success in prorating offshore production would open a temptation to apply the same rules onshore if a need arose . . . There always are some persons who are ready to ask the Government for help on their problems . . . The Government always appears ready to extend its authority at the least chance.

Indian lands are the potential spot for federal onshore intervention. Tribes in New Mexico, Arizona, Utah, and other western states never have been very happy about state regulation and probably would prefer that the federal Government control the lands.

Some Indian leaders say frankly they are currently going along with state regulation just so long as the states do a good job and treat Indian interests fairly.

Full control . . . If the federal Government moves into public lands, it almost becomes certain, oil men declare, that the Government will take over all proration functions everywhere.

The complications of overlapping authority would insure this. Situations exist where a reservoir lies partly under public lands and partly under private acreage. A compromise probably would be worked out so that both parcels were treated equally. In any event, the possibility is strong that state rules would be altered to fit federal ideas.

Even if agreement were reached to treat the operators and royalty owners in a divided pool alike, such problems as ratable take between fields and pipeline proration would persist. If the Government should set an allowable higher than that for equivalent state-regulated fields, ratable take would be upset. A common-carrier pipeline operator might well be caught in the middle if it became necessary for him to allocate space in his line.

So the entire question of the Government stepping into proration offshore opens up possibilities that disturb oil men who have given the matter serious thought.

Texas Cuts Allowable, But . . .

THE TEXAS Railroad Commission trimmed the state's allowable slightly for March, but indicated a change in attitude in setting the new allowable.

In recent months, commissioners have consistently gone along with lower nominations. But last week, they followed the highest nomination. Only five companies nominated 10 days. Six big buyers and a group of independents nominated 9 days and one company nominated 8 days.

During last week's hearing, it was pointed out Louisiana's allowables have remained high for months while Texas producers have been cut back severely. It also was pointed out some Texas oil has lost markets to the Louisiana oil.

The 10-day schedule for March will put the allowable at 2,900,568 bbl. February's allowable also was for 10 days, but with more days in March the allowable will be trimmed 147,938 bbl. below the initial February allowable and 114,404 bbl. from the February 6 figures.

Katy's LPG Pipeline Moves Closer

A KEY step toward construction of a 2,500-mile LPG pipeline system from West Texas-New Mexico to Minnesota and Wisconsin was taken last week.

Mid-America Pipeline Co., backed by the Missouri-Kansas-Texas Railroad, filed a registration statement with the Securities Exchange Commission. (The project was formerly called Mid-Continent Eastern Pipeline Corp.)

Financing is expected to be completed in the next 30 days, with Blythe & Co. heading the underwriting group.

Mid-America seeks SEC approval to issue $20,500,000 of 6½% subordinated debentures, due in 1980, and 1,230,000 shares of common stock. Securities will be sold to raise money for the $71,742,500 pipeline.

William N. Deramus III, president of M-K-T, is president of the Tulsa-headquartered pipeline firm, and Robert E. Thomas, chairman of the M-K-T executive committee, is president.

Considerable right-of-way has already been purchased. Pipe deliveries are to begin next month, and construction may be under way in April. Target for completion is this fall.

Product will be taken from gasoline plants in the Permian Basin and Texas Panhandle for shipment to Midwestern markets now served by rail and truck. An 8 and 10-in. main line will run from Eunice, N. M., to McPherson, Kans., carrying natural gasoline, butane, and propane.

From McPherson, branches will extend to Minnesota and Wisconsin. An 8-in. line will go to Minneapolis and a 6 and 8-in. line will terminate at Madison (OGJ, Dec. 14, 1959, p. 50). These lines will carry propane only.

According to the registration statement, Williams Brothers Co., Tulsa, which made feasibility and preliminary engineering studies, has the contract.

Should Texas Prorate Water Floods?

• Railroad Commission hopes to get answer at hearing set for April 19. It will be first time the question has been considered on statewide level.

THE TEXAS Railroad Commission last week called for April 19 what is likely to be one of 1960's most significant oil-regulatory hearings.

The commission will throw open to possible broad revision on that date its present system of distributing allowable to pressure-maintenance and secondary-recovery projects.

In its notice of hearings the commission noted that operators have pointed out and complained of differences in treatment between water floods started in depleted fields and pressure-maintenance operations.

"The commission desires to devise a plan that more nearly will provide equal incentive and distribution of allowable for future water-flood and pressure-maintenance operations."

The Texas agency also is inviting operator testimony as to whether it should set allowable ceilings for future water floods and other artificial drives. This in Texas, as in other states, has been in the past a subject of much controversy among operators.

Though the question of whether floods should be prorated has never been tackled at a special statewide hearing in Texas before, squabbles have frequently broken out at hearings over individual fields.

Humble Oil & Refining Co. campaigned actively in 1955 and 1956 in Texas for restriction of floods. It opposed capacity flood production at a number of hearings on individual projects before the commission. Its arguments briefly were that flood production could be restricted without damage to ultimate recovery and that, without restriction, it was mushrooming to the point that it was cutting allowables for new fields to unrealistic low levels, thus discouraging exploration.

Some other large operators go along with Humble in whole or in part. Some feel that modified restriction is feasible. And some have previously opposed any restriction.

Independents, especially those specializing in water-flooding operations, largely have in the past vociferously opposed restriction of any kind. Their prime arguments have been that curtailing flood production does harm ultimate production and that restricting floods to yardstick levels would not significantly reduce flood output anyhow.

Wide application . . . The Texas hearing will be viewed with acute interest by commissions and operators in other states because the problem involved there is a problem in nearly all U. S. producing areas.

Figures compiled by the Interstate Oil Compact Commission show the total number of flood projects over the country climbing rapidly. This same trend holds in Texas and in many other states.

In the current age of oil surplus, the growing number of floods is becoming a matter of increasing concern to state regulatory agencies as to what effects unrestricted flood output is having and will have on exploration.

Thus the question of whether they can or cannot be restricted without loss of oil becomes increasingly crucial.

The New Mexico Oil Conservation Commission decided after extensive hearings last fall that floods could be prorated and revised its regulations to restrict them.

Future emphasized . . . The Texas commission emphasized in its call for a hearing that it will consider only changes in its allocation system for future operations. Any change it might make in the current set-up as a result of the hearing would not affect projects now in operation.

Current policy in Texas is to permit stripper-field water floods to produce all the oil they can. One commission source has said this, in some relatively shallow fields, has permitted stripper flood wells to produce far more per day than those of equivalent depth in primary fields or in pressure-maintenance operations.

Too, the stripper flood is exempt from shutdown days under the Texas system, whereas pressure-maintenance projects are not.

This is a distinct advantage, especially so during the past several years when non-stripper-flood wells have been restricted to depressed 8 to 12-day producing schedules.

Pressure - maintenance projects in Texas have in some cases in the past couple of years been granted bonus allowable for injecting more fluid than they produce. But this allowable, where granted, does not exceed 25% of the rgeular allowable subject to shutdown days. It does not compare favorably, some operators contend, with the stripper-flood treatment.

New yardstick? . . . An informed source said in Austin last week that it appeared that the stripper flood may have an advantage.

He opined that the commission, after the hearing, might work out a new type of yardstick formula for allowables for artificial drives which would permit operators to know in advance what allowables they could expect from such projects.

Testimony sought . . . Here is what the commission says it wants from operators in the way of testimony at the April 19 hearings:

Should floods and pressure-maintenance projects "be placed on a comparable basis for distribution of allowable?"

Should the commission establish "an allowable ceiling for future water floods and/or pressure maintenance operation?"

Should input wells, "either converted producers or wells drilled specifically for injection usage be included in such allowable determination?"

Amoco's Coking-

AMERICAN Oil Co. dismantled a delayed coking unit in Louisiana and shipped its 10,000 pieces to Texas City.

Less than a year ago the coking unit thrust its 230-ft. frame into the sky at the former Amoco refinery at Destrehan (OGJ, Nov. 17, 1958, p. 145).

The coking unit charges 10,600 bbl. of reduced crude daily and produces 400 tons of coke, 6,000 bbl. of gas oil, and 2,300 bbl. of gasoline. Start-up at Texas City is scheduled for mid-March.

As the unit was dismantled, each piece was numbered and color coded according to plan by the contractor, Tellepsen Construction Co.

The two largest pieces are the coke drums themselves. Each drum is 18 ft. in diameter, 90 ft. tall, and weighs 155 tons. They moved by barge from Destrehan to Texas City, via the Mississippi River and the Intercoastal Canal, and then by rail to the site.

Texas' Welch Field Flood Gets Go-Ahead

OPERATORS in big Welch field in West Texas likely will start injecting water next month in a unitized waterflood program expected to boost total oil recovery from the pool's San Andres pay by 45,000,000 bbl.

Final obstacle to the flood was removed with Railroad Commission approval of unit and flood-program plans.

The new West Welch Unit takes in about 10,600 surface acres of the field in Dawson and Gaines counties, with about 8,280 acres of that amount productive.

It covers all of the field except the older, southeastern portion. The latter area, roughly a fourth of the total field, is expected to make up a second unit later.

Cities Service Oil Co. will operate the West Welch Unit.

Poor primary performer . . . The Welch San Andres has been a poor primary producer, even for a solution-gas drive reservoir.

There is very little gas in the crude. And producing energy has been due in part to expansion of the reservoir fluid. Even though the project area is considered to be in the marginal stage of depletion, gas-oil ratios average only about 203:1.

Cities Service, in an effort to improve recovery, kicked off a pilot flood in July 1955. Results were good. Efforts to organize the entire field into one unit were started in 1956.

The unit, as finally formed, takes in 208 produeing wells making an average of 12 bbl. daily each. Of this number, 177 are marginal, 13 have limited capacities below the 93-bbl.-daily top allowable, 1 is a top-allowable well, and the other 17 are in the pilot flood.

Unit engineers estimated that marginal producing operations at Welch might be extended perhaps as much as 65 years by repeated fracture treatments. Even so, however, total primary recovery likely would not exceed 17% of oil originally in place.

The first well in the unit area was completed in 1946—10 years after the field discovery in November 1936. Since then the unit area produced a total of 8,660,848 bbl. to November 1, 1959.

The flood plan . . . The unit will develop the West Welch waterflood on an 80-acre, five-spot injection pattern.

It will employ a closed system to inject water from the shallow Santa Rosa formation into the 4,900-ft. San Andres through a dozen input wells converted from producing service.

The water will be injected at an initial rate of about 360 bbl. per well per day and under initial pressure of 1,500 psi.

Unit engineers estimate the flood will reduce residual oil saturation in the pay at abandonment to about 44% of pore space.

Major acreage holders taking part, along with Cities Service, include Mobil Oil Co., Tidewater Oil Co., Cascade Petroleum Co., Carolyn Hunt Trust Estate, and Pure Oil Co.

Fifty-Barrel Move Delayed

OKLAHOMA'S 50-bbl. minimum allowable proposal isn't dead; it's just temporarily suspended.

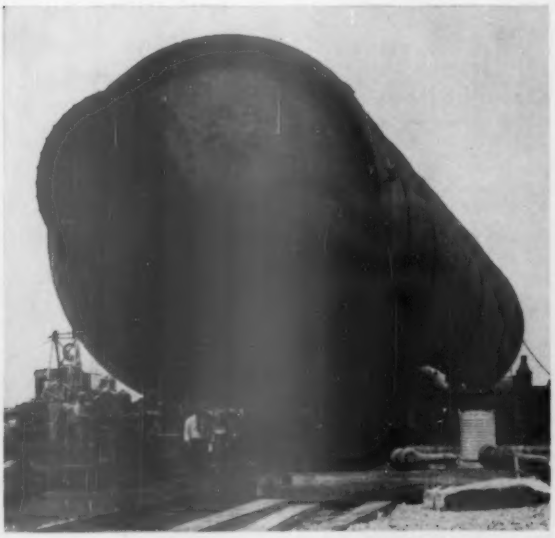
W. A. (Gus) Delaney, Jr., Ada independent who has been pushing for a minimum 50-bbl. oil allowable, last week said his proposal is "very much alive." But he is delaying plans to circulate petitions asking for a statewide election on such a constitutional amendment.

"We don't want this matter conflicting with other initiated measures," Delaney said.

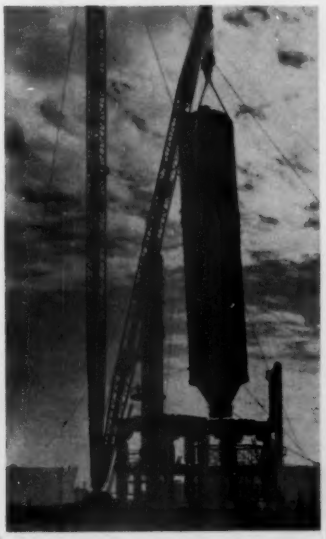
He was referring to three petitions sponsored by Gov. J. Howard Edmondson calling for statewide votes, probably in late spring. Delaney will delay his campaign until the governor's program is "out of the way."

Because the governor's reform measures might not reach a vote until fall, the Delaney proposal might be put off until 1961.

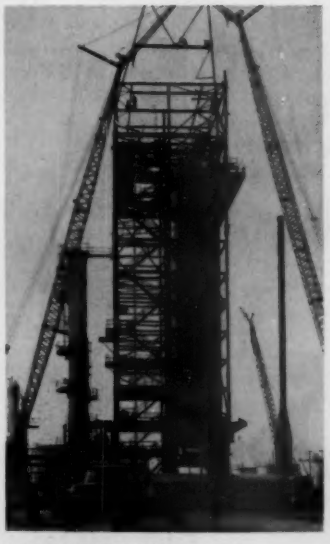
Unit Move Is Like Giant Jig-Saw Puzzle



COKE drum being loaded onto railroad flatcars at Texas City docks after barge trip.



GUY DERRICK lowers first coke drum onto foundation.



SUPERSTRUCTURE of coking unit begins taking shape.

Higher Standards for Geologists Urged

- A new organization which is in the making would police the geological and related professions. It would have a stiff code of ethics and membership requirements which would help identify and protect qualified geologists.
- This new association would replace the American Geological Institute and include all earth scientists. It would draw many members from the AAPG, SEG, AIME, and other oil groups.

REORGANIZATION of the world's geologists into a society clothed with full authority to enforce high professional standards is under way.

A committee of more than 80 earth scientists has tackled the task of:

. . . Setting up a new, over-all professional society to replace the present American Geological Institute.

. . . Enlisting support of the 26,000 to 30,000 members of other geological and scientific organizations.

Reason for the proposed sweeping changes stems from sentiment among geologists that the profession has become discredited by encroachment of unqualified persons who call themselves geologists. Need for some system of policing geological talents has been under study for 2 years.

State licensing and state registration of geologists has been proposed as one cure.

The plan to reorganize the institute into an umbrella professional society, with "big stick" powers to prevent phonies from invading the ranks, is an attempt to defeat these threats of setting up state-by-state registration of geologists. Segments in the profession feel self-regulation is much better than any plans for legislative regulation.

Several names already discussed for the new organization include "Academy of Earth Scientists" and "United Earth Scientists."

The new organization would have no power to keep anyone from practicing as an earth scientist. But other scientific groups, the courts, legislative and regulatory bodies, and the public would immediately be able to recognize an individual's professional qualifications and integrity if he were a member of the organization.

Who would join . . . The new organization, which would be world wide in scope, would have many oil men as members.

Professions which would be invited to join include:

Oceanographers; meteorologists; physicists; chemists; volcanologists, paleontologists, both vertebrate and invertebrate; petrographers; mineralogists; stratigraphers; geomorphologists; physical geographers; seismologists; exploration geophysicists; petroleum, engineering, mining, and ground-water geologists; hydrologists; petroleum engineers; survey members of all classifications; researchers; and academicians.

B. W. Beebe
. . "this is a bold and unique proposal."

All the 14 organizations which are now members of the American Geological Institute also would be invited to join. These include:

American Association of Petroleum Geologists; American Geophysical Union; American Institute of Mining, Metallurgical, and Petroleum Engineers; Association of American State Geologists; Geochemical Society; Geological Society of America; Mineralogical Society of America; National Association of Geology Teachers; Paleontological Society; Seismological Society of America; Society of Economic Geologists; Society of Economic Paleontologists and Minearologists; Society of Exploration Geophysicists; and Society of Vertebrate Paleontology.

What has been done . . . Idea for the sweeping reorganization originated within the American Geological Institute.

This is the Washington-headquartered body supported by the many scientific societies.

AGI directors felt that the association had outlived the war-time reasons for its creation, primarily as a government contact with the scientists. They felt the AGI should be either dissolved or strengthened to be of real service to the scientists.

They created a reorganization committee of more than 80 members, headed up by a seven-man executive group.

Chairman of this group is B. W. Beebe, Boulder, Colo. Other members are:

J. Robert Berg, department of geology, Municipal University of Wichita, Wichita, Kans.; George B. Cohee, U. S. Geological Survey, Washington; Sigmund I. Hammer, Gulf Research & Development Co., Pittsburgh; George C. Hardin, Jr., Michel T. Halbouty Co., Houston; William B. Heroy, Jr., Geotechnical Corp., Dallas; and Noel H. Stearn, Menlo Park, Calif.

All seven are members of AAPG, six are members of GSA, and four are members of SEG.

Duties of this group are to draft a new constitution for the organization to replace AGI and to propose long-term financing.

Its work has been and is being guided by written and oral recommendations from a group of 80 members of the 14 organizations, constituted as a permanent steering committee. First possible meeting of both the executive group and the steering committee could be in April at Atlantic City, at the annual AAPG convention.

To facilitate work of the executive group, Beebe has named two subcommittees. Hammer is chairman of a committee to draft a new constitution

Heart of the New Organization

MAINTAINING high standards for the men who practice geology and other earth sciences is one of the primary goals of the new organization which may replace the American Geological Institute.

To reach this goal, the men setting up the new organization have proposed a "professional institute" be organized within the over-all organization. This "professional institute" would have the twofold purpose of raising the standards of the profession and of challenging rights of incompetents to practice.

Here are some of the qualifications being considered for a man or woman to become a senior member of the "professional institute":

... **Must be a graduate** of an approved department of 4 years or more, with a major in any one of the earth sciences.

... **Have a minimum** of 8 years experience. Up to 3 years of graduate work may be considered experience. Teaching or research also may constitute experience.

... **Minimum age** of 30 years.

... **Membership applications** must be accompanied by letters of endorsement from at least five members of the institute.

... **The applicant must** sign an affidavit declaring he will abide by the code of ethics adopted by the institute.

... **In lieu of education** requirements, a record of 15 years experience may be acceptable.

An examining board would be set up to check all applicants. Procedures also would be developed to expel, suspend, or deny renewal of membership in the institute.

An initiation fee of $25 with a yearly renewal fee of not less than $15 has been proposed for the institute. There are suggestions that other classifications of memberships be authorized to include students and two or three other groups not having the full education and experience requirements of senior membership.

It has been estimated from 3,000 to 5,000 earth scientists immediately would accept the rigid requirements set up by the "professional institute."

with Berg and Cohee as members, and Stearn is chairman of a financing committee with Hardin and Heroy as members.

Because of the interlocking of memberships, proposals for changes and for the full reorganization must be submitted to the combined memberships for vote. In spite of this balloting and much necessary paper work, Beebe believes the reorganization can be activated "in a period of months." Beebe hopes to be able to submit the reorganizational plans to the various associations early in March.

Both R. C. Moore, president of the American Geological Institute, and Paul L. Lyons, immediate past president, have thrown their weight behind the proposals for complete reorganization of the AGI.

Opposition . . . The only opposition voiced so far to the reorganization of AGI has come from representatives of AIME and the American Geophysical Union.

A sharp division of opinion may develop among the far-flung membership of AIME. This institute has three distinct branches, which have their own officers and national conventions. They are the Society of Petroleum Engineers with about 13,000 members; the Society of Mining Engineers with roughly 12,000 members; and the Metallurigal Society with about 4,000 members.

Since engineers already have licensing status through state registration laws, they might take a second look at any move to align them under an earth-science banner.

A full vote of the AIME membership will be required to bring the institute into the new organization since AIME, as a national group, supports the present AGI.

Higher budget, dues . . . Although several proposed plans for financing having been submitted, no final decision has been reached.

The general organizational committee believes the present AGI budget of $80,000 annually would be inadequate. They figure an annual budget of $100,000 to $150,000 would be needed for the new organization.

One suggestion has been made that 10% of each member's dues paid to the 14 existing societies be diverted to the new organization.

Based on the proposed 10% assessment, contributions of the three biggest financial supporters of AGI would break down as follows:

... **AAPG,** present AGI contributions of $10,000 annually would increase to $25,500.

... **Geological Society** of America, present contribution of $10,000 cut to $6,600.

... **SEG,** contribution would increase to $4,100 from $2,000.

Magazine revenue . . . The committee considering refinancing and reorganization proposes to exploit the magazine GeoTimes, published the last 4½ years by the American Geological Institute. It is issued eight times annually.

It is distributed free to members of the societies.

The magazine now receives $3,000 annually from nonmember subscriptions and sales and about $17,000 from advertising revenue. The committee believes that subscription income can be boosted at least $10,000 annually to an over-all total of about $13,000.

By publishing monthly and increasing the circulation, the committee feels advertising revenue automatically would be increased to about $20,000 a year with possibility that these revenues eventually could reach $30,000.

The need . . . The men directing the campaign to put more teeth in qualifications for membership in an earth-science association say there is a definite need for such a move.

They cite a recent report from the AGI committee for the study of professional standards which said:

"There is no doubt our professional standards can and should be raised.

"There is no doubt a certain small percentage of undersirables in the earth-science professions damage us professionally in the eye of the public and should be eliminated from the profession.

"As it now stands, there are no real professional qualifications for an earth scientist to the layman."

Beebe's committee believes it can establish and enforce far more strict professional requirements than could be written into acceptable laws for registration and licensing.

"This is a bold and unique proposal," Beebe says. "The issue is clear cut. Do we continue to evade our professional repsonsibilities? Do we hide behind laws passed by nonprofessional legislatures of 50 states and 12 provincial and territorial legislative bodies?

"Or, do we have the guts to face up and win recognition through self-regulation? Only you and I can make this decision."

DOUBLE-JOINTED 34-in. pipe is dried in a heater before coating. It is shot cleaned, given a primer coat of coal-tar enamel, then given a four-stage final coating.

WELDING of the double joints is done in the ditch using the bell-hole method. This photo was made near Newberry, Calif.

PLGS Bell-Hole Welds 80-Ft. Joints

• Pipe laying is a little out of the ordinary on the 34-in. line being built by Pacific Lighting to take natural gas from Transwestern's new carrier.

THINGS are a little different along the right-of-way of Pacific Lighting Gas Supply Co.'s big-inch line in California.

They're using thick-walled 34-in. pipe, double jointed in the yard. They're saving money by taking delivery of hot enamel coating. And they're doing all of the right-of-way welding in bell holes.

The 116-mile 34-in. line will run from Newberry, in the desert near Barstow, to a connection with the Transwestern line, now under construction, 4 miles north of Needles on the California-Arizona border.

Here's how work on the big project is being handled:

Double jointing . . . The 40-ft. lengths of 34-in. X52 pipe are being double jointed in a yard at the west end of the line. PLGS specified that the inside pass be made first.

After yard coating, the 80-ft. lengths are trucked to the right-of-way.

Coating . . . The double-jointed lengths are dried in a heater, shot-blasted, and given a coaltar primer coat.

The main coating is made in this sequence: A 2/32-in. coat of a plasticized coaltar enamel, a glass innerwrap, another 2/32-in. enamel coat, then a final wrapping of 15-lb. asbestos felt.

The coating is designed to withstand severe alternating tensions and compressions expected as a result of moving gas ranging in temperature from 108° to 135° F.

An interesting feature is that the enamel is being delivered hot to the jointing and coating yard from a plant at Fontana, some 125 miles away. It it transported in insulated tank trucks. It leaves Fontana at about 525° and arrives at the yard between 495 and 500°.

It is applied to the pipe at temperatures between 485 and 500°. PLGS says it is saving about $5 a ton by taking hot delivery. It estimates it will use 33,000 tons on the 116-mile line.

After enough pipe has been double-jointed and coated to take care of about half of the project, the whole yard operation will be moved to a site at Henderson, Nev., near the eastern end of the line.

Welding . . . The entire line is being laid by the bell-hole method, which PLGS specified for these reasons:

. . . Costs. It is no more expensive than over-the-ditch work, PLGS says, in view of its unusually severe welding requirements.

. . . Safety. By making the final welds with the pipe in the ditch, the line will be subject to less stress from handling.

. . . Welding requirements. PLGS requires use of four welders on the stringer and hot-pass beads and not less than two on the filler and completion beads.

Also, PLGS specified that the line-up clamps may not be removed until the stringer bead is completed. On the stringer and first hot-pass beads, each welder does a quadrant. This requirement is to insure uniformity in heat application.

Inside welds on pipe in the ditch are not being made except at points where wall thickness changes. Two thicknesses, .469 and .566 in., are being used on almost all the Class A line. The only non-Class A points are at highway and rail crossings.

Why so tough? . . . PLGS says its

strict requirements for the project, mostly in uninhabited desert, result from two principal reasons: It is using high-test pipe, and it expects high-temperature operations.

PLGS, jointly with Transwestern, also is making a change from normal local practice in crossing the Colorado River at the border.

It has been the practice to bridge the river with gas lines. PLGS and Transwestern plan to bury two 24-in. lines 14 ft. below the river bottom. They will be 500 ft. apart.

PLGS also has a stringent rule on bends and angles. Maximum vertical bends are restricted to 9° per 80-ft. length. Horizontal angles are limited to 120-ft. radius bends.

The line is being built at a rate of 1 to 1½-miles a day. Completion is slated for June 25. Deliveries from Transwestern are expected to start July 8. Initially, the line will take around 200,000 M.c.f. daily from Transwestern with design provisions for eventually upping that to 600,000 M.c.f.

Contractors on the $17,300,000 line include: Pacific Pipeline Construction Co., Engineers Limited Pipeline Co., and Missouri Valley Dredging Co.

The tie-in . . . The PLGS line will tie-in at Newberry with a 36-in. line. Southern California and Southern Counties Gas companies will build from there to Placentia in the Los Angles basin.

Work on the Newberry-Placentia Line, labeled the "Cajon Pass Pipeline," will start early in March.

The Cajon Pass line will handle new gas coming into the state from the Transwestern and the proposed Rock Springs lines.

Contractors on the Cajon project include Young & Anderson Co., Brea, Calif., which will build the line from Newberry to Fontana (about 85 miles), and Hood Construction Co., Whittier, Calif., J. P. Neill & Co., Dallas, and River Construction Co., a subsidiary of Morrision-Knudsen, Los Angeles. The latter three companies will build the Fontana-Placentia phase of the 115-mile line as a joint venture.

The Newberry-Fontana segment involves uninhabited desert and mountain regions. The Fontana-Placentia segment will be built in largely urban areas.

Where Imports Come From

THE OIL IMPORTS Administration last week issued a country-of-origin breakdown of imports for the period from March 11 through December 31 for crude and unfinished oil, and from April 1 through December 31 for products and residual fuel.

Similar reports will be issued each 6 months. Here are the OIA figures, in thousands of barrels daily:

	District 1-4	District 5
Crude Oil		
Borneo	...	13.6
Brazil	3.5	...
Canada	56.0	38.4
Colombia	32.5	2.6
Iran	3.5	25.0
Iraq	18.3	...
Kuwait	118.8	31.0
Neutral Zone	20.2	20.2
Qatar	...	0.03
Saudi Arabia	43.2	17.5
Sumatra	...	52.6
Syria	3.7	...
Trinidad	...	0.5
Venezuela	417.2	39.9
TOTAL	716.9	241.3
Unfinished Oil		
Borneo	...	0.05
Brazil	0.3	...
Canada	...	0.2
Italy	0.5	...
Japan	...	3.0
Kuwait	10.2	1.6
Netherlands Antilles	0.5	0.6
Neutral Zone	...	0.2
Trinidad	3.1	1.7
Venezuela	12.8	5.4
TOTAL	27.4	12.8

	District 1-4	District 5
Finished Products		
Canada	...	0.9
Kuwait	0.5	...
Netherlands Antilles	42.0	4.9
Trinidad	0.8	...
United Kingdom	0.7	...
Venezuela	28.6	0.7
TOTAL	72.6	6.5
Residual Fuel		
Bahrein	0.3	...
Brazil	0.4	...
Canada	0.9	...
Colombia	0.4	...
Cuba	0.7	...
Kuwait	12.1	...
Mexico	24.2	...
Netherlands Antilles	107.8	...
Neutral Zone	4.3	...
Saudi Arabia	0.3	...
Trinidad	1.4	...
United Kingdom	0.8	...
Venezuela	201.0	...
TOTAL	354.6	...

All imports into Puerto Rico were from Venezuela. They included: Crude oil, 65.5; unfinished oil, 11.3; finished products, 1.9; and residual fuel, 1.5.

Louisiana Plans New Forms to Simplify Reports

LOUISIANA is going modern in its oil production reporting systems, and it plans to bring order out of chaos in the designation of leases.

Within the next 2 months producers on some 12,000 leases in the state's 300 fields will be furnished new production forms which will be identical for three state departments—the conservation department, the state mineral board, and the revenue severance tax division of the revenue department.

The forms will be geared to IBM machine use and processed at the revenue department's data-processing unit for the benefit of all agencies involved.

R. T. Lindbeck, coordinator, says the new reporting system, with machine processing, will give Louisiana an over-all audit of oil production, eliminate manual paperwork, and provide each of the three agencies basic information heretofore available only on piecemeal basis among them.

The system will, among other things, give the severance-tax division a quick check on whether taxes have been paid on all production.

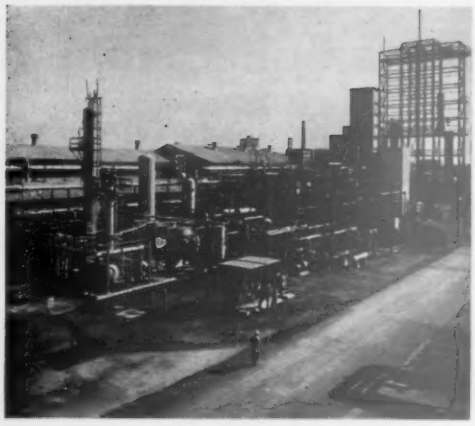
New lease code . . . In connection with the new plan, the state is compiling a master code manual which gives a code number to each lease and field in the state.

In the past, the names of leases have been changed when owners changed, and there has been uncertainty in designating leases. Hereafter a lease will bear the same code number throughout its life.

Lindbeck said the new system will go into effect as soon as the manual is completed, probably within 60 days.

While oil production is the only phase of the industry affected at this time, gas production may be brought into the system later.

"Gas is a more complicated business," Lindbeck says. "We will go slow until we know how it ought to be done."



SUN'S ammonia plant at Marcus Hook, Pa., produces 300 tons per day. About 40% of its output is piped across the Pennsylvania-Delaware state line to . . .

Ammonia →

← Hydrogen

SUNOLIN'S urea plant at North Claymont, Del., which will make over 200 tons per day. A secondary product is hydrogen, which will supply some of the Sun refinery's needs.

Sun Optimistic About Non-Oil Tieups

• Oil firm's alliances with Olin Mathieson Chemical and American Viscose are aimed at strengthening its position in the petrochemical field.

A NEW urea plant goes into operation about March 1 at North Claymont, Del.

This isn't particularly significant in itself. But as a milestone in the corporate development of an oil company, it's quite unusual.

The oil firm is Sun Oil Co. The plant will be operated by SunOlin Chemical Co., a joint venture of Sun and Olin Mathieson Chemical Corp.

SunOlin was the first such venture for Sun. The company has a similar agreement with American Viscose Corp. to found AviSun Corp.

The two deals involve direct affiliation of oil with non-oil interests. That means Sun is taking a road seldom followed by oil companies—with the exception of joint oil and rubber operations during the war.

The oil-rubber alliances were dictated largely by the need for synthetic rubber during the war. Sun's ventures have been undertaken solely by choice—not necessity.

The tieups with Olin Mathieson and American Viscose will neither affect Sun's crude-oil position nor add to its outlets for such volume products as gasoline and distillates.

Sun's reasons . . . The ventures will greatly strengthen Sun's position in the field of petrochemicals, however.

Petrochemicals are a growing and profitable field. Even during the 1958-59 recession, production, sales, and profits of many petrochemicals continued to grow.

However, this situation isn't necessarily permanent. Production eventually will catch up with demand, as it already has for some products. When it does, markets and profits will tighten. It will be a staggered development. Some products will oversupply the market. Others will remain in short supply.

It was partly in anticipation of such unpredictable times that Sun made these alliances. Both Olin Mathieson and American Viscose are established in the manufacture of end products. These alliances will give Sun an immediate market for much of its chemical production. And, they will assure it outlets when, and if, the going gets rough.

SunOlin . . . James I. Harper, SunOlin's president and Sun's coordinator of chemical manufacturing and sales, says, "Both companies had factors of equal value. It was logical for them, therefore, to be equal partners."

Olin Mathieson manufactures high analysis fertilizer, and urea production complements its marketing position. SunOlin products will be marketed by Olin Mathieson.

The Sun-Olin Mathieson relationship is sort of an over-the-fence operation since the SunOlin site in Delaware adjoins Sun's refinery site just across the state line at Marcus Hook, Pa. SunOlin will get its raw materials from Marcus Hook through pipelines.

SunOlin's first unit—the $8-million urea plant—will have a capacity of more than 200 tons per day. Its daily output will include 167 tons of prilled urea and 55 tons of crystal urea. The plant uses the Fauser - Montecatini process under license from the Italian chemical firm, Montecatini of Milan.

SunOlin, with its first process not yet in operation, already is making expansion plans. The plans include an ethylene plant, expected to be in operation by the fall of 1961. The $15-million plant will process dry gas from the Marcus Hook refinery's gas-recovery system and will produce 200 million pounds of ethylene per year. Other products will include ethylene oxide and glycol.

AviSun . . . Chalmer G. Kirkbride, AviSun president, considers the Sun-American Viscose venture appropriate because of Sun's research in polymers and American Viscose's conversion of polymers into film and fiber.

AviSun has a polymer plant at Port Reading, N. J., about 100 miles northeast of Marcus Hook, and film and fiber plants at New Castle, Del., about 25 miles from Marcus Hook. The plants are to be supplied with raw materials from the refinery by tank-car and tank truck.

AviSun will market its own products.

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resources of production,
transportation and storage,
plus . . .
WARREN'S
experience as a specialist
in its field
assures you of

DEPENDABLE *deliveries*
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TEXAS CITY AND WARRENGAS, HOUSTON, TEXAS, SAN PEDRO, CALIF.

Scouts to Make Weekly Count of Active Rigs

- **Report will be circulated to industry by AAODC. It will include cable tools, rotaries rigging up or moving.**

A NEW WEEKLY count of active rigs is now virtually certain to be made available to the industry soon.

The new rig check will be compiled by the International Oil Scouts Association and distributed by the American Association of Oilwell Drilling Contractors.

The scouts' count will differ considerably from that now made by Hughes Tool Co. and distributed by AAODC.

It will include both rotary and cable tool rigs and will report the number active in each scout-check area.

The new count's definition of "active" also will differ from that made by Hughes. The Hughes report counts only rotary rigs—and only when the rotary table on a rig is actually turning.

It does not count a rig which is rigging up, tearing down, cementing, logging, testing, or fishing. The new report will include all of these, according to M. R. Proctor, chief scout for Atlantic Refining Co. and chairman of the IOSA's rig-count committee.

Drilling contractors generally feel that rigs are "active" when so engaged and that a count which shows how many are actually working and unavailable is a real need. So the new check will define a rig as active from the time it starts rigging up until it is released by the operator.

Early start hoped . . . Planning is not yet so far advanced that the IOSA can pin down the date of its first report. But Proctor told the Journal he hopes it will be within 3 months and may be sooner.

The actual counting probably will be done by the various local checks and funneled to the association's headquarters in Austin each week for compilation.

Some local checks will also issue a detailed report showing active rigs by counties. The report going to Austin, however, will show only the numbers of active rotaries and cable tools in the over-all area covered by each local unit.

The mechanics of gathering the data will be relatively simple. The scout responsible for each sub-area within a scout-check area will turn in a count of the rigs in his sub-area at the weekly meeting.

These will be compiled on the spot and the totals dispatched to Austin.

The whole thing, Proctor says, should require just a few minutes at the local level each week.

So far, Proctor said, roughly two-thirds of the IOSA local groups have agreed to take on the rig-counting chore. He said the association had not yet heard from the remainder—but there had been no negative response.

The association first started contacting its member groups in January following its annual meeting. Proctor noted that the association has no authority to order its member groups to participate. Participation is entirely voluntary. "We have always cooperated with the drilling contractors when we could, however, and they with us. And we want to help again this time."

Coverage will have holes . . . Though the new count will show more rotary rigs than the Hughes check for corresponding areas, it will not cover as much territory.

The IOSA has no local groups, for instance, in such areas as Pennsylvania, New York, West Virginia, and Ohio. The nearest group to this eastern area is the Tri-state group for Indiana, Illinois, and Kentucky.

It apparently will not cover the current play in Tennessee. And there is some doubt that the drilling fillip in the Green County, Kentucky, area is covered by the Tri-State group.

Also there is some uncertainty as yet as to whether such states as Washington and Oregon will be covered.

The new count will cover California and Canada and will be especially strong in the Mid-Continent and Southwest. Proctor said hopes are also to include Alaska.

Despite the holes, however, contractors and others contacted by the Journal generally feel that the report, when it materializes, will be highly useful. "It should give a clear picture of drilling activity," one said, "wherever it covers."

Indications now are that the AAODC will distribute, at least for a while, both the Hughes and the IOSA rig counts.

Kansas Ratable Take Ruled

A STATE-WIDE ratable taking rule for all Kansas gas wells was put on the books by the Kansas Corporation Commission last week. It provides that each purchaser take ratably from the wells to which it is connected in a common reservoir.

It effectively cancels the ratable-take order against Northern Natural Gas Co., effective October 7, 1959, and substitutes a general order covering Northern and all other companies.

Effective February 8, the rule provides that:

"In each common source of supply under proration by this commission, each purchaser shall take gas in proportion to the allowables from all the wells to which it is connected, and shall maintain all such wells in substantially the same proportionate status as to overproduction or underproduction."

The rule does not apply to wells which are unable to produce proportionately.

PIPELINE BRIEFS . . .

Some 352 miles of 30-in. looping is planned by Trunkline Gas Co. this year as part of a $45-million expansion. A 140-mile supply lateral will be laid in Louisiana, including 17 miles of 24-in. loop and 123 miles of 20 and 26-in. The construction program will enable Trunkline to increase deliveries by 200,000 M.c.f. daily to its parent company, Panhandle Eastern Pipe Line Co.

A 75-mile 30-in. line is planned by Northern Illinois Gas from underground storage at Troy Grove to its distribution system near LaGrange, Ill. Pipe is being stockpiled at Earlville, Plano, and West Chicago for the $10-million project, which will be started in early spring and completed by September 1. At the beginning of the year the company had injected 4.8 billion cubic feet of gas in Troy Grove's porous sandstone, which will hold a supply capable of serving 50,000 to 100,000 homes during the winter. Northern Illinois has available a supply of 518,131,000 cu. ft. daily and expects to have an additional 143,580,000 cu. ft. by this winter.

New terminals at Norfolk, Neb., and Yankton, S. D., have started operation on the Kaneb Pipe Line Co.

Louisiana to Require Better Nominations

• Allowables exceed nominations by 100,000 bbl. daily, and Mouton wants to know why. Plan will require more complete reporting of purchases.

LOUISIANA has followed through with its plan to find out why there's a 100,000-bbl.-daily spread between nominations and purchases from Louisiana oil fields (OGJ, Dec. 21, 1959). The crude buyers themselves will provide the answers.

While not terming it a crackdown, Conservation Commissioner Ashton Mouton has notified all purchasers he expects full cooperation in a revised program for reporting actual crude needs.

Specifically, this means that companies must report not only what they buy directly from the producers but also from intermediaries. This information will make it possible for the conservation department to find out which purchasers are failing to make nominations.

Mouton has complained for several months that nominations are unrealistic and do not furnish a reliable basis on which to fix Louisiana production allowables.

For example, nominations totaled only 831,200 bbl. daily for March and 833,405 bbl. daily for April. Actual production for January and February will average about 936,000 bbl. daily.

"Somebody ought to be nominating for all the oil," Chief Engineer Tom Winfiele said at Baton Rouge last week. "We haven't been requiring enough detailed information as to the activities of the purchasers. We're not calling names—we just want to get better information."

What's required . . . Under the new system, each purchaser will be asked to state his nominations by fields for a period of 2 months, plus any additional purchases from other parties. Also he will be asked to list all purchases made during the previous 2 months.

The conservation department, with this information, then can determine easily which crude has not been nominated and then go directly to the purchaser and find out why.

The new checkup plan goes into effect for the next nominating period, May and June. Nominations are due about April 12, and the allowables will be set later that month.

Mouton was in the process last week of preparing letters of instructions to accompany the usual allowable hearing notices to oil companies.

The commissioner advanced the plan informally at the last allowable hearing. Winfiele said the companies appeared eager to comply.

Mouton said he expects to fix the March and April allowables at about the same level as January and February, allowing for an increase for new production. The allowable will rise from 967,000 bbl. daily to about 980,000 bbl. daily. Actual production is falling about 30,000 bbl. daily below the 967,000 bbl. figure, but the nominations ran below it by well over 100,000 bbl. daily.

Products Line in North Dakota Planned

A 200-MILE 8-in. products pipeline reportedly is planned for North Dakota this spring.

The line would extend from Glendive, Mont., to Minot, N. D. It would be built by Farmers Union Central Exchange of St. Paul, Minn.

The Central Exchange owns a 19,000-bbl. refinery at Laurel, Mont., and part of the Oil Basin products line from Laurel to Glendive.

The only products line originating in North Dakota runs from the Standard Oil Co. (Ind.) refinery at Mandan southeastward to the Twin Cities and Iowa.

Great Lakes pipeline has a spur extending from Moorhead, Minn., and Fargo, N. D., to Grand Forks, N. D.

Other activity . . . In other North Dakota pipeline activity, the state Public Service Commission has set hearings on five applications to build crude-gathering systems in northern counties.

A March 3 hearing will consider two applications for a system in Wiley field, Bottineau County. Applicants are International Refineries, Inc., Wrenshall, Minn., and Barron Kidd, Dallas.

At a March 9 hearing the commission will hear testimony from three companies who want to gather crude in Burke County.

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products line. The terminals are located on the 279-mile 6-in. extension of the line completed last fall. Kaneb also has completed an interchange connection with Great Lakes Pipe Line near McCool Junction, Neb. This gives Great Lakes shippers a direct pipeline outlet into northern Nebraska and South Dakota. The Consumers Cooperative refinery at Phillipsburg, Kans., newly connected to Kaneb, is tendering products through the new 6-in. line into the new Fairmont terminal near Geneva, Neb.

A 1960 construction outlay of $49 million, some $9 million above 1959, is planned by Northern Illinois Gas. For the 5-year period 1960-64, $180 million will be spent on construction, including $33 million for storage and transmission facilities.

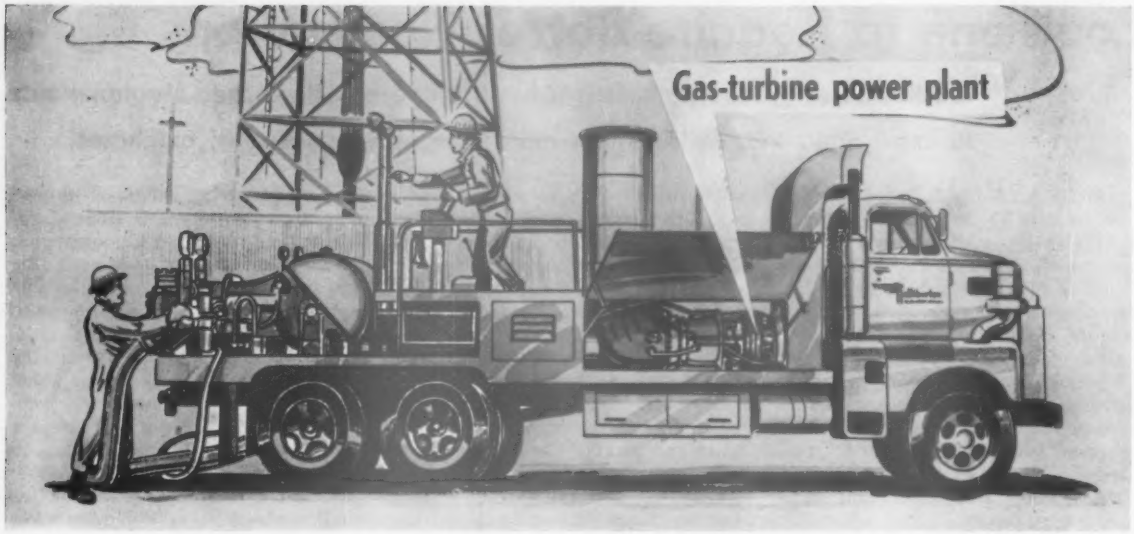
A delivery terminal will be built at Waterloo, Iowa, this spring by Great Lakes Pipe Line Co. This will be the fifth terminal in Iowa to which Great Lakes shippers can consign products in major consuming centers. The Waterloo terminal will be served by a 58-mile 8-in. line which ties in to the company's main system at Grinnell, Iowa, and is part of a $10-million expansion begun last year.

Also for Pipeliners . . .

IN THE NEWS: Katy's LPG pipeline from West Texas to Minnesota is a step nearer reality after company files registration statement with SEC (p. 65) . . . Unusual pipe laying and welding feature the 34-in. line being built in California by PLGS (p. 70).

A complete list of pipeline projects is carried in the last issue of each month. Current projects are covered in Pipeline Briefs.

PLUS THIS TECHNICAL REPORT: Use nitrous oxide to spot pipeline leaks (p. 100).



HERE'S HOW AN ARTIST sees a Halliburton fracturing truck equipped with a gas-turbine power unit.

Halliburton to Test Turbine for Fracturing

THE FIRST oil-field application of General Electric's Model 720 gas-turbine engine will be in the field of well fracturing.

Under the terms of an agreement with GE, Halliburton Oil Well Cementing Co. will test the 900 hp. Model 720 in its laboratory for 6 months and will then use it as a drive for a fracturing pump for another 6 months of field testing.

For the field-test portion of the Halliburton program, the model 720 will drive a triplex pump delivering an oil and sand slurry up to 1,100 g.p.m. at pressures to 8,000 psi.

The power plant weighs only 1,200 lb. and is 7 ft. long. The entire unit, pump and power plant, occupies only a portion of the truck platform.

Big advantage of applying turbine power to a fracturing pump is that a smaller, lighter truck may be used, as the turbine weighs substantially less than conventional piston-type engines. Further, the turbine unit needs no warm-up period and is ready to deliver full power as soon as started. No cooling run is needed either, so fuel is saved at both ends of the working cycle.

The program will get under way later this year.

INDUSTRY BRIEFS . . .

The Amarillo Scout Check will vote March 9 on a proposed merger with the Liberal Scout Check. Consolidation of the two checks has been suggested to end a disagreement between the two groups over jurisdiction in the Oklahoma Panhandle and part of the Texas Panhandle.

A report on U. S. proved crude-oil reserves will be made by a special committee just appointed by National Petroleum Council Chairman Walter S. Hallanan. Report will cover proved reserves by years through 1954, with estimates of reserves as of December 31, 1959. L. F. McCollum, Continental Oil Co. president, will be committee chairman.

Next company to appear before the Oil Import Appeals Board will be Sinclair Oil Corp. on February 29. The March schedule is: March 7, Golden Eagle Refining Co.; March 11, Standard Oil Co. (N. J.); March 18, Pacific Supply Cooperative; March 21, Deepwater Oil Terminals, Inc.; March 23, Blue Ridge Fuel Co., Inc., and Car Care System.

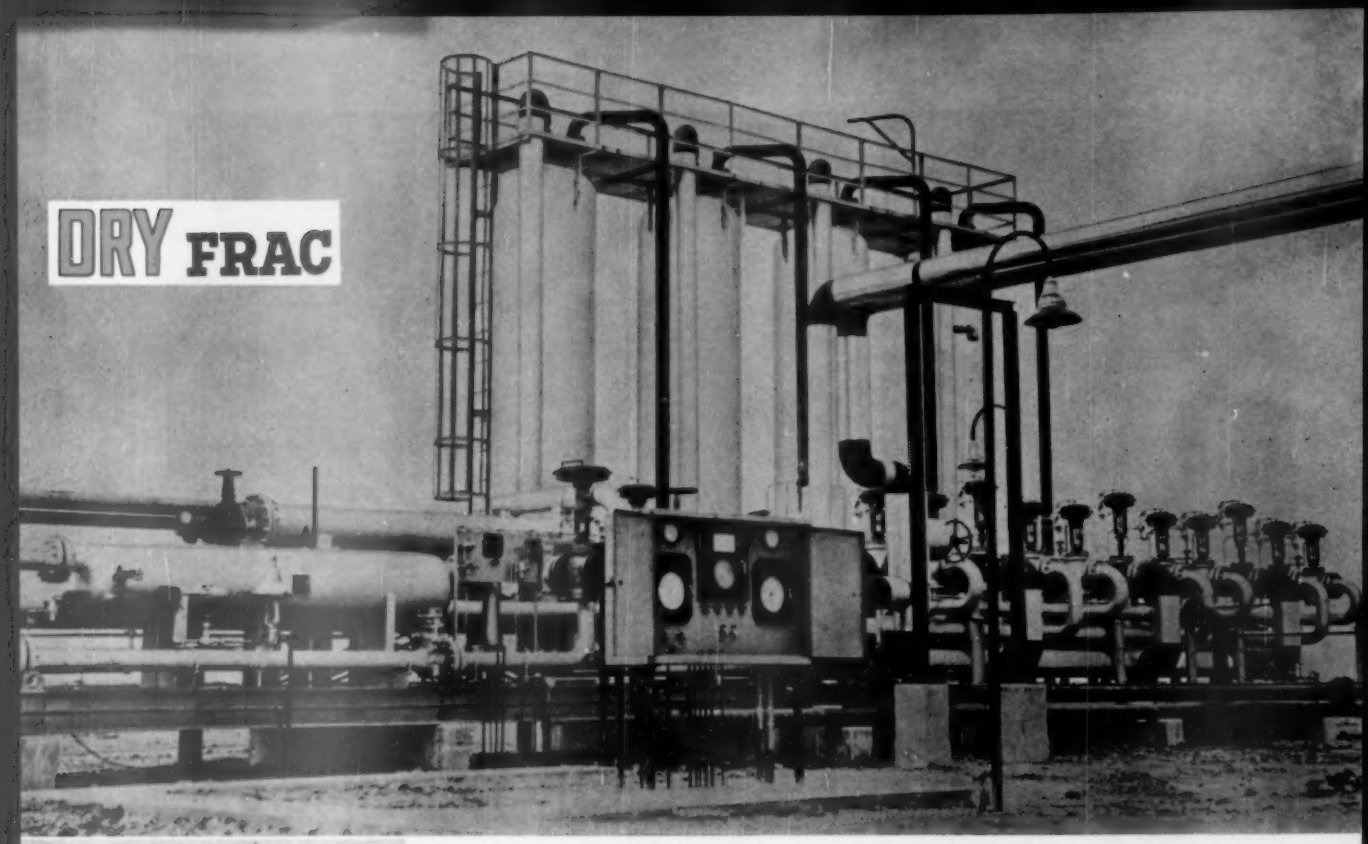
Humble Oil & Refining last week broke ground on its 44-story, $32-million building in downtown Houston. President Morgan Davis turned the first spade of dirt while top city officials looked on. The building will be completed by mid-1962.

Stanton Oil Co., San Antonio, has completed a pilot water flood in Turkey Track field, Eddy County, New Mexico, and ultimately will expand the project to 720 acres with 18 drilling units of 40 acres each. Stanton recently purchased 70% interest in the field and has more than 1,000 acres under lease. Present production in the stripper field is from the Queen formation.

Louisiana's oil allowable will be held at the current level through March and April. Conservation Commissioner Ashton Mouton said that with the allowable for March and April set at about 880,000 bbl., actual production will be near 949,000 bbl., some 118,800 bbl. above total nominations.

An oil and gas advisory committee of 29 men, to recommend improvements in conservation practices, has been named by the Kansas Corporation Commission. At the same time, the commission set up new 40-acre production and spacing rules for 10 fields in seven Kansas counties. The rules provide for 1 bbl. of production for each 100 ft. of depth to the pay horizon. The wells will average about 43 bbl. daily. Wells on less than 40 acres will have allowables reduced proportionately.

Oklahoma Natural Gas Co. has added 2,000 customers in Madill and Tishomingo, Okla., by purchase of the Standard Gas Co., which formerly served these communities.



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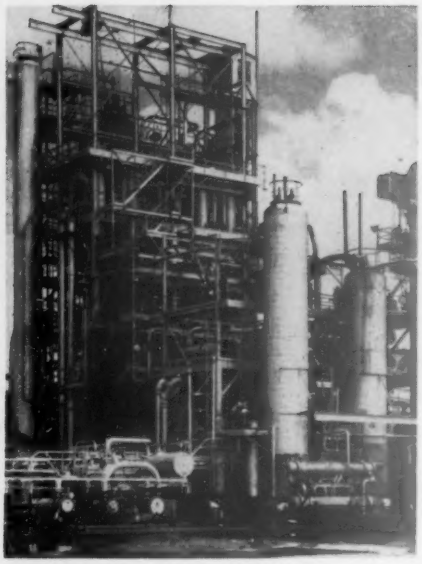
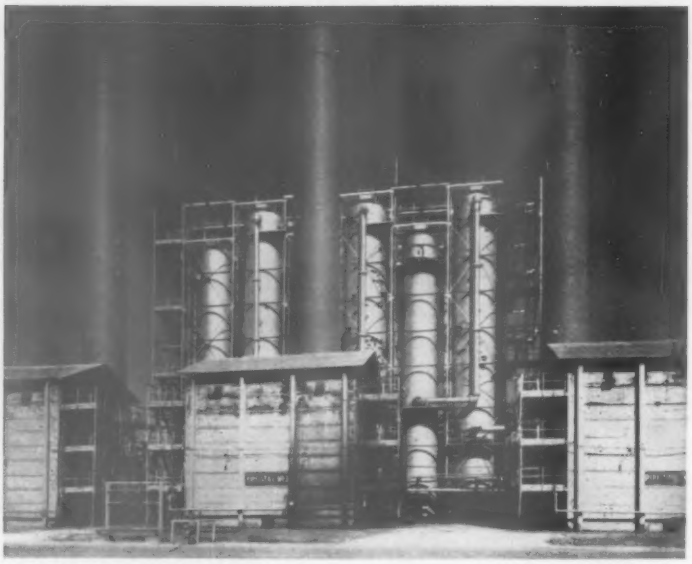


POLYFORM UNIT is relatively new, but outdated and idle. Its future is a question.



PIPE STILLS are headed for the scrap heap. They have lost their jobs to a 100,000-bbl. modern crude unit at Baytown.

Process Obsolescence Is Costly to Refiners

ALL OF THE plants in these pictures are now idle.

They're still in good condition and can perform well the jobs they were designed to do. But technology has made them old before their time.

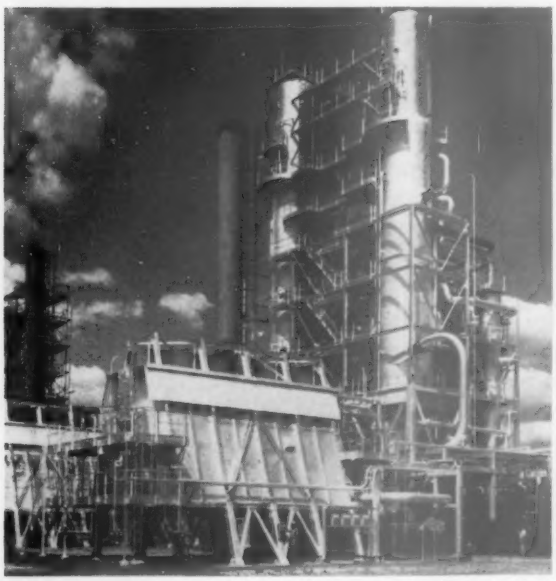
They are all in the Beaumont refinery of Mobil Oil Co., and they demonstrate graphically how competition—in product quality—has made these plants obsolete and has required the building of entirely new units.

Actually, these photos tell only a part of Mobil's Beaumont story. There are more than a dozen process units idle there.

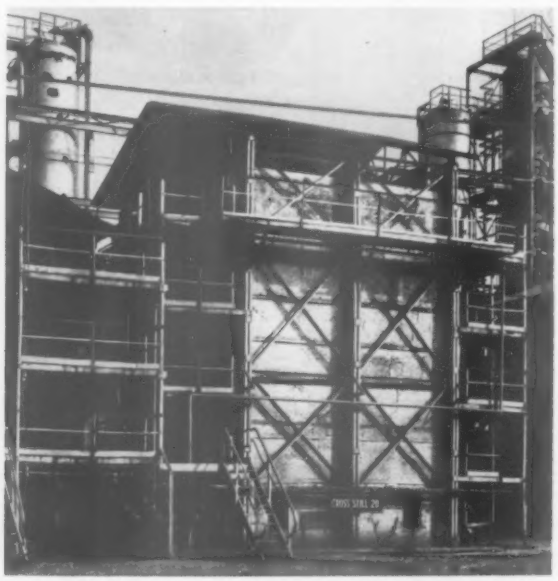
In some cases these obsolete units have been revamped and put to different uses. More often, they become scrap. Unlike automobiles, they have no trade-in or resale value. As competition pushes up quality, those units which can't meet the new standards die.

At Beaumont, some of Mobil's process units are simply worn out. But most are just obsolete.

Some are oldtimers. Gas Compressor Plant No. 2 went in service in 1924. Pipe Stills 2, 3, and 4 were built in the late 1920's, as was Cross Still 20. These stills were the first continuous crude-fractionating units at the refinery. Since then they've been modified frequently and extensively.



VACUUM UNITS are only 10 years old but have been idled by big, new crude unit.



OLD CROSS STILL has in recent years served as a pipe still and as a visbreaker, but it now is not needed.

But in recent years the cost of keeping them in good operating shape has climbed. And the product they turned out was no better than in the late 1920's. As one Mobil employe puts it: "They were four-cylinder units in an eight-cylinder age."

Mobil has now completed and is operating a modern 100,000-bbl. distillation unit to get back on eight cylinders. And pipe stills 2, 3, and 4 are being torn down.

Two more pipe stills, 11 and 12, also were put out of action by the new crude unit and are on stand-by.

Still another victim is Cross Still 20. This unit started up in 1929 as a cross still. In recent years it has swung back and fourth between pipe still and visbreaker. With the new crude unit plus a new vacuum tower at the plant's combination unit, the old still is no longer needed and is shut down.

Gas plants down . . . New centrifugal compressors and high-pressure absorption equipment at the plant have knocked out permanently one gas-compressor plant (No. 2) plus the absorbers and compressors at another (Gas Plant 3).

New facilities at Gas Plant 5 West recovers more of the propane, butane, and heavier hydrocarbons from the gas streams. Gas Plant 3's stabilizer and debutanizer towers are in stand-by status.

New units hit, too . . . Relatively new process units are among the Beaumont victims of obsolescence, too. And this is where it really hurts.

The plant's big Thermofer catalytic reformer was shut down only 3 years after it went on stream in 1955. The octane parade caught up with it.

The unit supplied blending stock for high-octane motor gasoline. But a newer process, platinum catalyst reforming, produces higher octanes and does it cheaper.

Now, the big TCR unit has been converted, at heavy expense, to a platinum catalyst reformer.

Older than the TCR but still relatively new, Mobil's Beaumont Polyform unit also has reached the end of the operating line—at least for now. This unit, built in 1941, is smaller than the TCR and not well suited to conversion. It is in good shape. But its future is a big question mark.

Completion of Crude Unit A, along with the dooming of the pipe stills, left the plant's North and South Vacuum Units without jobs. And they're only 10 years old. The units were used to process residuum from the pipe stills. They're now in dry dock.

Supply Deal Made

. . . between U. S. firm and Mexican marketer.

REID OIL CO., Long Beach, has made a deal with Servicio Cal-Mex, S.A., to supply the Mexican marketer with fuel oil and other petroleum products.

Servicio Cal-Mex, in turn, has a 20-year concession with Pemex to market in Baja, Calif., under the Pemex label. As part of the concession, Servicio Cal-Mex will build a Pemex-designed terminal and offshore unloading line at Ensenada. Pemex will take over ownership of the terminal and line at the conclusion of the 20-year concession.

Reid has been taking delivery of Japanese gasoline at Wilmington, Calif., where it is held under bond until it is tank trucked to Tijuana. The company has received an estimated 7.5 million gallons of Japanese gasoline since deliveries started last November.

The gasoline, made by the Idemitsu Oil Co., reportedly is delivered to Reid for an estimated 8.5 cents a gallon at tanks leased from Edgington Refining Co. in Wilmington.

PROCESSING BRIEFS . . .

Sun Oil Co. has brought on stream a $2,000,000 propylene plant at its Marcus Hook, Pa., refinery. The new facilities have potential capacity of 120,000,000 lbs. per year of 99.9% pure propylene from the refinery gas streams. Present production is going to AviSun Corp.

The American Petroleum Institute has published the fourth edition of "Fire Protection in Refineries." The new publication (RP 2001) provides the most recent information on safe storing, handling and processing of petroleum products. Copies may be obtained from API headquarters in New York.

Frontier Refining, Denver, has purchased the stock of Western States Refining, Salt Lake City, for approximately $5.5 million. Frontier paid $3.50 per share for about 1,634,831 shares outstanding. Western States properties include a 5,500-bbl. refinery at North Salt Lake, Utah, and a 1,200-bbl. plant at Farmington, N. M.; ownership or control of 165 service stations under the "Beeline" name in Utah, Idaho, Nevada, New Mexico, and Colorado, and 54,739 acres of "prospective oil leases."

L. Sonneborn Sons, Inc., New York, refiner and chemical specialties manufacturer, is changing its name to Sonneborn Chemical & Refining Corp. and adopting a new company symbol. This change is to give a clearer picture of the company's activities.

Humble Oil & Refining has purchased 13 stations and equipment from Southern Arizona Petroleum Co., Tucson. Three other stations served by Wes Grantham, a Wilcox jobber, will also be converted to Humble stations.

A new vacuum pump system for unloading antiknock compounds at refineries has been developed by Ethyl Corp. Ethyl says the pump, which produces a high vacuum under all conditions, speeds up unloading operations.

Ethyl Corp. will build a vinyl chloride monomer unit at its Houston plant. The unit will supplement Ethyl's Baton Rouge vinyl chloride plant. Completion of the Houston facility is scheduled for early 1961.

Dow Chemical International, Ltd., S. A. has formed Dow Chimica Italiana, S.p.A., as a wholly-owned subsidiary in Italy. The new company will open its marketing office in Milan in March. Dow is considering the production of a number of products at plant.

Also for Refiners . . .

IN THE NEWS: Imports appeal board has ticklish question: What happens to refiner's quota if plant on strike? (p. 63) . . . Amoco moving a coking unit from old Destrehan refinery to Texas City (p. 66) . . . Sun optimistic about its non-oil tieups which give it stronger position in petrochemicals (p. 72) . . . Obsolescence cost in processing equipment dramatically displayed at Mobil's Beaumont refinery (p. 78).

PLUS THESE TECHNICAL REPORTS: Control computer shows high service factor (p. 102) . . . How furfural extraction upgrades cat-cracker gasoline (p. 120).

AIME's New Officers Assume Posts

NEW OFFICERS of the American Institute of Mining, Metallurgical, and Petroleum Engineers and its three branches took office last week at the 89-year-old AIME's annual convention in New York City, attended by 4,000.

Dr. Joseph L. Gillson, chief geologist of Du Pont, is AIME president.

Wayne E. Glenn, Houston, manager of Continental Oil Co.'s production department there, became president of the Society of Petroleum Engineers. Dr. Arthur B. Cummins, Manville, N. J., Johns-Manville Corp., assumed presidency of the Society of Mining Engineers, and Dr. Carleton C. Long, Monaca, Pa., St. Joseph Lead Co., is new president of the Metallurgical Society.

New AIME vice presidents are John Chipman, Massachusetts Institute of Technology; Jerome W. Woomer, Pittsburgh consultant; Stanley D. Michaelson, Salt Lake City, Kennecott Copper Corp.; Basil P. Kantzer, Los Angeles, Union Oil Co. of California; John P. Hammond, Tulsa, Amerada Petroleum Corp., and Dr. Walter R. Hibbard, Jr., Schenectady, N. Y., General Electric Co.

Gillson, graduate of Northwestern University, served in World War I, taught at Harvard and M.I.T. from 1921 to 1928, was associated with the U. S. Geological Survey 6 years, and has been with Du Pont since 1928.

Glenn is a native of Fort Worth, received his petroleum engineering degree from the University of Oklahoma, and has been with Continental since. He was graduated from the American Management School in 1954 and the Harvard Advanced Management Program in 1957. He was Continental production assistant in the Rocky Mountain area, Denver, for 6 years until he transferred to Houston last year.

Dr. Joseph L. Gillson
. . . new AIME president.

Wayne E. Glenn
. . . heads petroleum engineers.

New vice presidents of the SPE are R. A. Morse, Pittsburgh, Gulf Research & Development Co., and William D. Owsley, Duncan, Okla., Halliburton Oil Well Cementing Co. New directors are A. E. Collins, Wichita, Vickers Petroleum Co.; Robert L. Hoss, Denver consultant; Harold J. Maiers, Caracas, Venezuela, Socony Mobil Oil Co. de Venezuela; and J. E. Russell, Abilene, Texas, Russell Engineering Co.

President-elect of AIME, who will take office following Gillson's term in 1961, is Ronald E. McNaughton, Trail, B. C., Canada, Consolidated Mining & Smelting Co.

Earl M. Kipp, San Francisco, Standard Oil Co. of California, is SPE president-elect, to take office in 1961.

James C. Gray, Pittsburgh, U. S. Steel Corp., is president-elect of the Society of Mining Engineers, to take office next year. J. S. Smart, Jr., New York, American Smelting & Refining Co., is president-elect of the Metallurgical Society.

Appeals Set for Texas Town-Lot Fracture Fight

IF AN OPERATOR fractures a well and extends fractures across his lease line, is he trespassing on the adjoining operator's property?

State district courts in Texas are ruling both ways.

Four law suits on this question are now before appellate courts, two in San Antonio and two in Austin. All four involve wells drilled on tiny town-lot tracts in McAllen-Pharr gas field under the city the Pharr.

Delhi-Taylor Oil Corp. and Mayfair Minerals are the contestants on one side, with three independents on the other.

Latest development in the court fuss came last week when Delhi and Mayfair appealed from two adverse decisions by a district court in Hays County, Texas.

The court held that Delhi and Mayfair should have gone first to the Texas Railroad Commission in situations involving three small-tract wells drilled in the field by A. W. Gregg, Houston operator.

One of the two suits concerned a Gregg well on a 0.42-acre townsite lot. The other two involved similar nearby wells drilled on 0.2 and 0.4-acre lots. The lots involved are islands in a big drilling unit set up by Delhi and Mayfair.

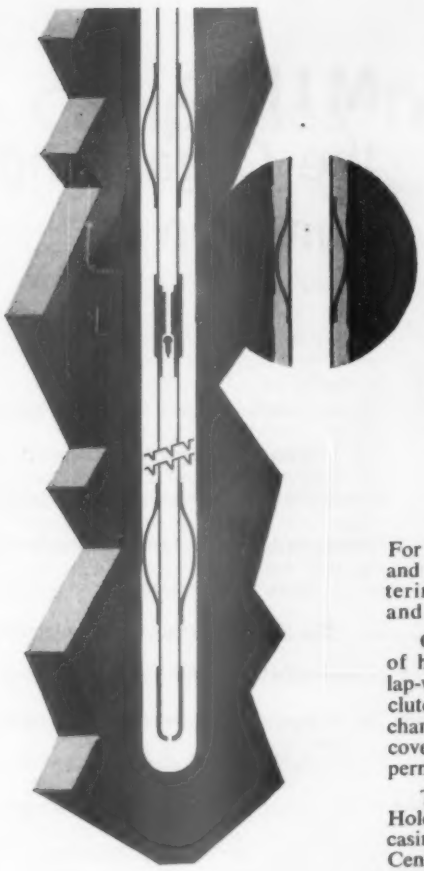
Decisions clash . . . The district court's decisions in the Gregg cases are in direct conflict with decisions made earlier by different judges in two cases in state district court in Edinburg, Hidalgo County.

Both judges held that tiny-tract wells drilled by different operators in the same portion of the field as the Gregg wells would be a continuing and damaging trespass if fractured.

In each case the judge issued a temporary injunction restraining the small-tract operators from fracturing across lease lines (OGJ, Dec. 21, 1959, p. 48).

The decision was appealed to the appeals court in San Antonio and the case is now set for March 9.

The appeal was carried to the court by Coastal Gulf Oil Co. and Kenneth Fox, drillers of a well on a town lot entirely surrounded by Delhi-Mayfair leases. The second suit involved a well bottomed by Dugger & Holmes, San Antonio, under a street intersection in Pharr which likewise was completely circled by Delhi-Mayfair leases.



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Other advantages with the "S-3" Centralizer... centralizer springs designed of heat treated spring steel to withstand punishing down-hole conditions—lap-welding of springs to end band reduces breakage and side hole damage—no clutching or gripping to casing while rotating or reciprocating—helps prevent cement channeling—better overall well completions... one size centralizer designed to cover a range of hole sizes for each O.D. casing size from 4½" to 24" O.D.—permits ease of ordering.

There is a Halliburton Casing Centralizer designed for every well... "Slim-Hole" Centralizers are tailored for specific slim holes drilled or for liners run inside casing; available in 3½" O.D. liner through 9⅝" O.D. casing sizes... "Tubing" Centralizers help protect tubing and collars against wear when string is pulled and re-run; also for wells where tubing is used as production string or in water injection wells for maximum centering and better placement of cement; available in 2" EUE through 3½" EUE sizes.

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  for superior load-carrying capacities.
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  ... new method of installing auxiliary equipment on casing or tubing at selected spacing without welding. This economical tool is hinged for easy installation and has been tested with loads exceeding 20,000 lbs. in either direction.

EZ LOK LIMIT CLAMP

- **SOLID SET SCREW LIMIT RING**
  ... surpasses many non-weld limiting devices and stop collars in capacity load to limit movement of centralizers on casing without welding—not illustrated.

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Companies Trim Venezuelan Holdings

• Many long-shot areas are being dropped even though operators know they may never get additional acreage. Barinas and some border concessions forced on the companies during Maracaibo bidding are the big losers.

OIL COMPANIES are letting the axe fall often and hard on their Venezuelan concessions in an effort to pare the fat from the lean.

Surrenders and expirations of exploration and exploitation rights last year totaled 3,602,557 acres, probably the biggest reduction in the country's history. Ironically, the cutback came at a time when the Venezuelan Government repeatedly warned that the present administration would grant no concessions—now or in the future.

Much of the acreage involved covered ram pasture that companies took grudgingly in order to win desired tracts in Lake Maracaibo. But the action shows companies are no longer willing to play along with exploration programs on areas that hold little promise.

A box score of concession changes last year shows that:

...41% of all exploration and 7.6% of all exploitation acreage was either dropped or expired.

...There is less acreage under concession now than before the major awards in 1956 and 1957.

...Companies are not hesitating to give up vast tracts, despite the fact they may never have an opportunity to get more.

There is now 14,212,980 acres under concession, including both exploration and exploitation territory. This

Venezuelan Concession Owners and How Much They Control

Company	Surrendered or Expired in 1959*		Concessions as of Dec. 31, 1959			
	Exploration	Exploitation	Exploration	% Change	Exploitation	% Change
Shell	27,056	71,998	.....	−100%	2,315,709†	+ 18%
Colon Oil	.....	74,759	.....	...	.....	−100%
Creole Petroleum	72,430	37,514	148,200	− 33%	2,801,795	− 2%
International Petroleum	.....	.....	.....	...	15,149	...
Mene Grande	.....	.....	.....	...	2,579,461	...
Mobil Oil	.....	665,949	.....	...	1,173,843	− 36%
Sinclair Venezuelan	.....	217,464	.....	...	953,608	− 19%
Texas Petroleum	.....	.....	.....	...	525,537	...
Coro Petroleum	.....	.....	.....	...	91,894	...
Las Mercedes	.....	21,818	.....	...	635,025	− 3%
Caracas Petroleum	.....	18,142	.....	...	227,175	− 7%
Continental	.....	.....	.....	...	151,376	...
Pancoastal Petroleum	.....	29,116	.....	...	61,950	− 32%
Venezuelan Atlantic	24,700	.....	102,604	− 19%	3,194,735	+ 3%
Guasare Oil	.....	.....	.....	...	19,535	...
Esperanza	.....	.....	.....	...	188,518	...
Phillips Petroleum	.....	.....	49,400	...	297,237	...
Richmond Exploration	.....	.....	.....	...	552,154	...
Espanola de Petroleos	.....	.....	.....	...	79,193	...
Venezuelan Sun	24,700	.....	.....	−100%	49,400	...
Superior	24,700	.....	.....	−100%	8,773	...
Ven. Amer. Ind. Oil Pr. Assoc., Inc.	.....	.....	23,589	...	2,077	...
Pan Venezuelan	24,700	.....	74,100	− 25%	92,405	...
San Jacinto	24,700	.....	24,700	− 50%	26,669	...
Signal Oil	98,800	.....	.....	−100%	27,602	...
Talon Petroleum	.....	.....	.....	...	7,565	...
Julio de las Casas	.....	.....	.....	...	1,235	...
King-Mill Oil Co.	.....	.....	73,952	...	.....	...
Texaco Seaboard	.....	.....	.....	...	13,585	...
Monagas Oil	.....	.....	.....	...	18,831	...
Carlos H. Maury	.....	.....	.....	...	5,402	...
Totals	**321,767**	**1,136,758**	**496,544**	**− 41%**	**13,716,436**	**− 7.6%**

*In addition to surrenders and expirations, there were changes due to transfers of properties between companies, and changes in the classification of some properties.

†Includes 425,034 acres acquired through merger of Colon Oil into Shell.

is slightly less than the area under concession in 1955. It is 14% less than 1957, at the conclusion of awards.

Barinas fades . . . The biggest turn back was made in Barinas. Socony Mobil de Venezuela and Sinclair Venezuelan, who jointly own a crude pipeline to the Caribbean from the area, both gave up large tracts.

Socony relinquished 665,949 acres, or 54% of its holdings in the state. Sinclair gave up rights to 217,464 acres. Exploration by the two companies, as well as by others, has failed to turn up an important discovery since the Sinco find in 1953.

Shell changes . . . Cia. Shell de Venezuela gained exploitation rights to 425,034 acres through the acquisition of another Royal Dutch-Shell company, Colon Oil. But Shell group exploitation acreage on the balance declined almost 6%.

The decline was due to relinquishment by Colon of more than 74,000 acres in southwestern Venezuela near Tarra oil field. The acreage involved essentially was a narrow strip around the outside of the concession. Shell gave up nearly 72,000 acres of exploitation rights, including a 27,000-acre tract 9 miles east of Tia Juana.

Shell gave up the last of its exploration acreage when it relinquished 27,056 acres on the Colombian border northwest of Mara oil field. The company held back 5,118 acres, converting it to an exploitation tract by payment of slightly more than $12 per acre.

This was the only conversion of exploration to exploitation rights made by any company during the year. It also was the first border tract held by any company to be converted.

Three newcomers to Venezuela gave up all their exploration concessions when they relinquished border acreage in Zulia and Apure. Signal Oil turned back 98,000 acres, and Superior and Sun each gave up 24,700 acres.

Of the 496,544 acres remaining under exploration concession, a little more than half is in Barinas. Creole Petroleum has 148,200 acres in the state, Venezuelan Atlantic, 53,204 acres, and King-Mill Oil, 49,400 acres.

The rest of the exploration territory lies in the border states of Western Venezuela. Pan Venezuelan (Indiana Standard) has 74,100 acres, and Atlantic, 49,400 acres in Apure. San Jacinto has kept 24,700 acres in Tachira.

Venezuelan American Independent Oil Producers holds 23,588 acres, and King-Mill, 24,552 acres in Zulia. Phillips Petroleum has 49,400 acres in Tachira and Zulia.

Reports from Caracas are that more large blocks will be given up this year. Texaco is expected to relinquish 204,301 acres in the Buchavacoa area in the State of Falcon, Western Venezuela. Venezuelan Atlantic is believed to be considering a turn back of extensive rights in Eastern Venezuela and in Barinas.

Pattern Set for Venezuelan Labor Agreement

- **Oil workers win 10 to 12% pay hike in 3-year contract signed with Creole, Shell, and Mene Grande.**

FOR MORE than 2 weeks Caracas had heard repeatedly that the Venezuelan oil industry's new labor contract would be signed "by the 15th."

Venezolanos listened and they asked slyly, "Which month?"

This time the rumors paid off. Negotiators for the country's big three oil companies and the executive committee of labor's Fedepetrol wound up more than 5 months of wrestling with a bulky 165-clause, 50-page document that contained labor's demands.

The 3 a.m. signing ceremony and formal registry of the new 3-year contract with a beaming labor minister, Luis Hernandes Solis, was almost an anticlimax. President Romulo Betancourt had already sprung the news of the agreement 2 days before in a speech marking the first anniversary of his administration.

Hailed in Caracas as one of the most generous in the industry, the new contract gives Venezuela's 42,000 oil workers new benefits at an estimated cost of $100 million to the industry. About 47% of the added cost will be borne by the government in reduced income from the industry.

The $100-million cost is a far cry from the union's initial estimate of $120 million when the contract talks started. It is even further from a woeful $1.2 billion cost estimate made by the industry after it took a startled look at labor's demands.

When all the smoke cleared, labor said it was satisfied with the new contract. The industry called the new pact acceptable. Only the communist representatives in the labor camp did not sign the contract. Everyone was proud of the fact that it had all been done without any government intervention.

Labor Minister Solis commented on the "harmonious attitude" of both camps during the long negotiations.

Here are the primary points agreed on:

. . . **Wage boosts** of 10 to 12% in most brackets. The average unskilled workers weekly pay goes up from $42 to $47. For the average skilled employe the increase will be from $84 a week to $93.

. . . **A 40-hour week** for salaried employes and a 44-hour week for hourly workers.

. . . **A 30-day annual** paid vacation plus a $60 vacation bonus.

. . . **New medical** and educational benefits.

The final terms of the contract, as in any labor negotiation, represent a compromise. Labor's initial demands of pay raises ranging from 15 to 20% were immediately labeled by the industry as prohibitive. Labor also wanted a 40-hour week with pay for 56 hours, 30-day vacations with 60 days pay, and a long list of additional fringe benefits. (OGJ, Sept. 7, 1959, p. 118).

The contract signed last week covers only Creole Petroleum Corp., Cia. Shell de Venezuela, and Mene Grande Oil Co., the country's three biggest operating companies. Similar contracts with all other companies operating in Venezuela are expected to be signed within a week now that the broad base agreement has been established.

Soviet Crude Passes Goal

RUSSIA'S crude production passed its goal last year, but growth in the natural-gas industry was not up to expectations.

Crude output rose 14% to 129.5 million metric tons, or about 2,590,000 bbl. daily. The Russians say this and production of several products was ahead of the scheduled growth.

Gas output rose 25% to an all-time peak of 37.2 billion cubic meters, or about 3.6 billion cubic feet daily. Despite the gain, output was below the Russian goal, and growth was considerably under the 48% increase of a year earlier.

Wild Well Becomes Japan's Best Gas Producer

JAPAN has nearly doubled her natural-gas supply with a single new 35,000 M.c.f. daily discovery which blew out twice before it could be controlled and completed.

The well is under limited production of about 2,500 M.c.f. daily because the local market in Niigata is limited. A $6-million project for a 100-mile pipeline to move the gas to Toyama is already under way and will be completed before the end of this year.

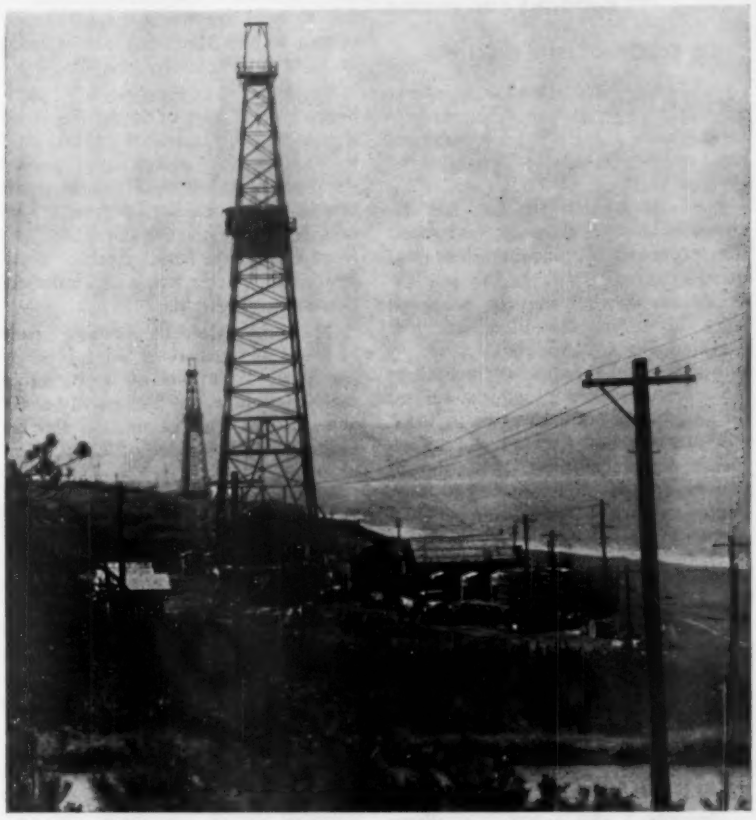
Teikoku Oil Co., Japan's principal oil and gas producer, made the discovery at Katamachi 16 in the Kubiki field where the company has carried on exploration since 1953. The field is about 80 miles southwest of Niigata city in a west Japanese coastal region where Teikoku has a number of small producing oil fields.

The first blowout occured December 30 as the company was attempting to complete the gas producer in two gas zones. One, with a 30-ft. pay, was topped at 3,140 ft. The other, only 13 ft. thick, is at about 3,340 ft.

Japanese crews were able to control the first blowout, but when the well kicked again January 10, the company called in Myron Kinley, Houston oil well fire-fighter, to bring it under control. Kinley's efforts were successful after well blew wild for a full week.

Aside from the very respectable estimated flow potential of the well, the Japanese are excited because they have apparently tapped a gas reserve in a well closed anticline. Up to now Teikoku has produced about as much salt water as it has gas in the gas wells it has completed in Niigata.

About 80% of the 48,000 M.c.f. of gas produced daily in Japan last year was dry gas similar to the new discovery. The big difference is that there has always been a heavy flow of brine along with the gas.



THE TRANQUILITY of Japan's Kubiki gas field was disturbed by a blowout in Katamachi 16. But the wild well has been capped—and it is by far the best gas producer in the country. It is rated at 35,000 M.c.f. daily.

Salt-water disposal from these wells, plus the expense of equipment replacements caused by corrosion, account for the 64-cent per M.c.f. sales price of gas in Japan. High withdrawals of salt water have also accounted for land subsidence in Niigata.

Teikoku Oil believes it will be able to reduce gas prices 20 to 30% because of the brine-free gas discovery. The Kubiki gas is analyzed as 97.3% methane; 1.3% ethane; 0.5% propane; 0.4% isobutane; and 0.5% carbon dioxide.

Neutral Zone Crude May Be on Market Soon

THE JAPANESE-OWNED Arabian Oil Co. is wasting no time developing and moving the Persian Gulf oil which they found early this month.

The company has let a contract with two American construction and dredging firms for shore facilities to handle the oil. Contract calls for dredging a tanker channel, road and shore facilities, and a 500-ft. wharf to be completed by May 1 at Ras al Khafji in the Neutral Zone.

Work will be done by Pomeroy Construction Corp., San Francisco, and Hawaiian Dredging & Construction Co., Ltd., in a joint venture.

The dredging project calls for a mile-long channel that will be 18 ft. deep and 250 ft. wide, indicating that the Japanese plan to ship from relatively shallow draft tankers at first.

The early completion date will not be as difficult as it might be for other contractors. The Pomeroy-Hawaiian Dredging combine is already working on a $23 million harbor project for the Government of Kuwait. Much of the heavy equipment to be used in the construction is already in Kuwait.

The first well drilled by the Japanese company, Khafji No. 1. More than 25 miles offshore, found a prolific 500-ft. Cretaceous sandstone pay from about 4,700 to 5,200 ft.

Initial test results revealed by the Japanese rated the well at about 6,300 bbl. daily, but it will certainly produce at a much higher rate. The crude is 26.6° gravity and contains 2.7% sulfur.

The company is now drilling a 2½-mile stepout to the discovery to the southwest from the LeTourneau-type platform, being operated by International Drilling Co. A second fixed platform served by a tender is expected to be put into service by Seacat Drilling Co. by June.

Iran Sets Deadline

. . . on bidding for leases in parts of six districts.

A CHAPTER of Iranian oil history will end this spring when the government closes the door to bidding on open acreage in interior Iran and the Persian Gulf.

National Iranian Oil Co. has declared a May 15 deadline for concession proposals for uncommitted areas of Districts 1, 3, 4, 8, 14, and 18. While the districts may be reopened later, no offers submitted after the deadline will be considered.

Iran opened the districts to bidding on a piecemeal basis under a revised oil law that became effective in 1957.

While the law provides for agreements giving complete ownership of concessions to companies, the only deals made included the Iranian Government as a partner.

District 1, covering Iranian offshore waters in the northern part of the Persian Gulf, is considered one of the world's prime exploration areas. To obtain rights, two companies, subsidiaries of Italy's ENI and of Pan American (Indiana Standard), each went into partnership with NIOC. If commercial production is developed, Iran will receive the big end of a 75-25 profit split.

Districts 3 and 4 are in southern Iran, along the Gulf of Oman. District 8, 14, and 18 lie in the interior of Iran, north of the consortium area.

Tapline Deliveries Down

TAPLINE is feeling the pinch of low tanker rates.

Deliveries from the Sidon, Lebanon, terminal of the big-inch pipeline from Saudi Arabia were at the lowest level last year since 1956, averaging 336,394 bbl. daily. Capacity of the 1,069-mile system to the Mediterranean is rated at 450,000 bbl. daily.

Trans-Arabian Pipeline Co. attributes a large part of lower deliveries to the world surplus of tankers and the resulting low tanker rates between the Arabian Gulf and the Mediterranean. The company operates a 754-mile section of the 30 and 31-in. line from Qaisumah, Saudi Arabia, to Sidon. Aramco operates a 315-mile section in Saudi Arabia.

The f.o.b. price of Arabian crude of about 35° gravity at Sidon is $2.29 per barrel. This is 40 cents more than crude of about 34° gravity available at Ras Tanura on the Persian Gulf at a posted price of $1.89.

Equipment Loans Pushed

BRITISH equipment firms are expanding their program to develop foreign sales by joint action.

Thirty manufacturers which formed British Oil Equipment Credits last year are studying the possibility of extending more credit to Pemex and are sending a mission to Argentina for preliminary talks with YPF.

The firms, through British Oil Equipment, offer credit as a group to potential foreign customers. The loan is then used to buy equipment from individual members.

Ten million in credit was extended to Pemex last year for the purchase of refinery equipment in United Kingdom. Orders for $7 million worth of materials have been placed. The firms hope to extend the credit to a total of $20 million.

Saharan Oil Sold

. . . to Japanese in return for $5-million loan.

ONE OF the owners of Hassi Messaoud field is lending $5 million to a Japanese oil company—and is getting a crude sales contract in the bargain.

The marketing subsidiary of Cie. Francaise de Petroles, Total International Corp., is loaning the $5 million to Asia Oil Co. The Japanese firm will use the money for an expansion program that includes construction of a 30,000-bbl. refinery at Yokohama.

A preliminary agreement has been signed for the loan, and a formal agreement will be concluded soon. Asia Oil will pay off the debt at 6% interest over a 7½-year period starting 6 months after the loan is made.

Asia Oil, in turn, expects to start importing 4,500 bbl. daily of crude from the CFP subsidiary. Purchases will increase to 8,000 bbl. daily in the immediate future.

CFP owns half interest in Hassi Messaoud through another subsidiary CFP (Algeria). The big field was opened to major production in December with the opening of a 420-mile 24-in. pipeline to the Mediterranean.

The crude sold to Japanese, however, may possibly originate in the Persian Gulf where CFP has 23.75% interest in Iraqi and 6% interest in Iranian production. Crude picked up at Fao, Iraq's port of the Persian Gulf, or in Iran would eliminate the need for a trip through the Suez Canal and would require a shorter tanker haul.

This would also help solve CFP's problem of selling its Middle East oil in other markets in the face of growing supplies for France in Algeria.

FOREIGN BRIEFS . . .

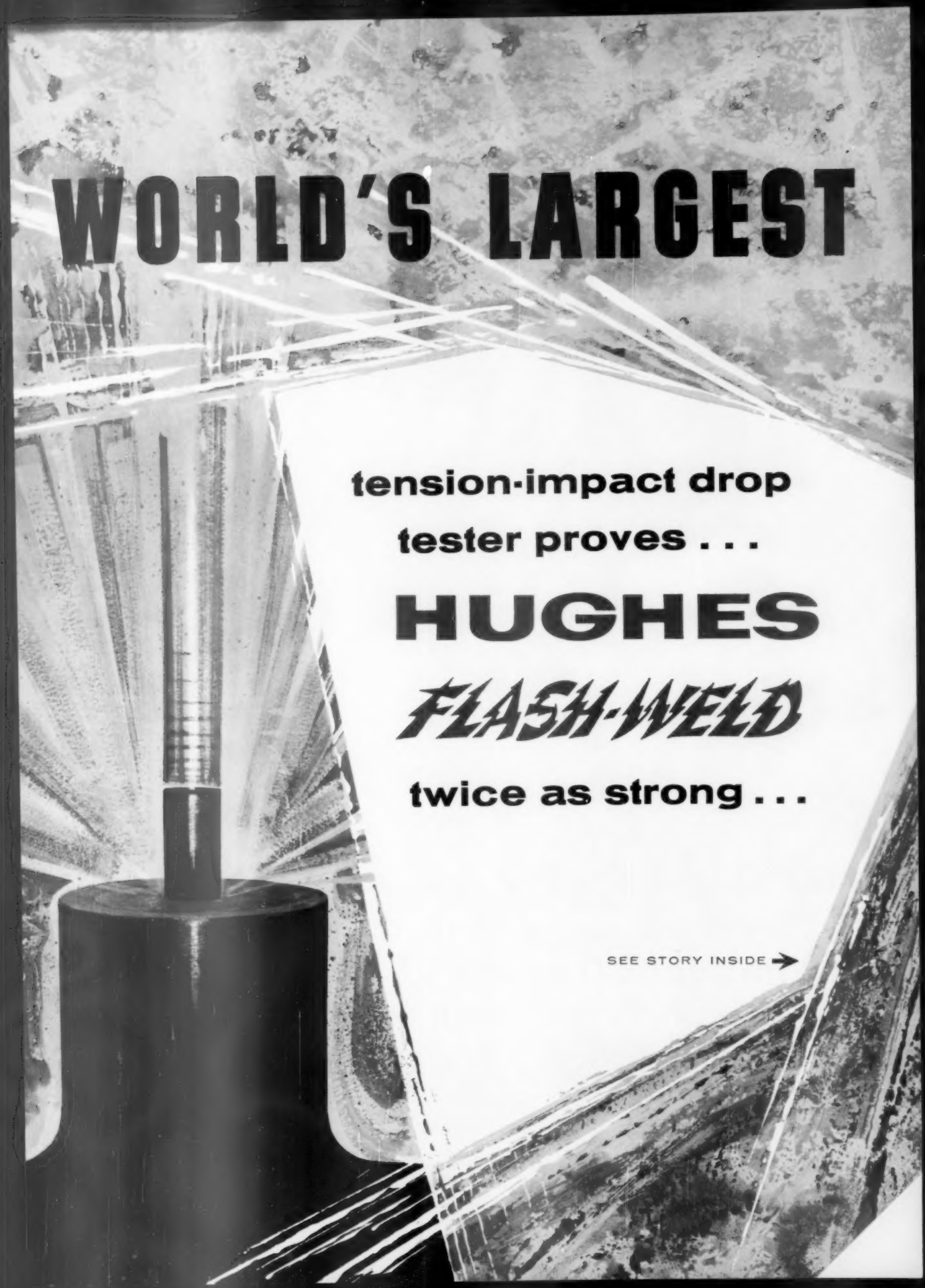
Production tests on a natural-gas discovery at Port Campbell, Australia, indicate the reservoir is small. The wildcat initially tested 4 million cubic feet. daily from 5,656-68 ft. to give the country its best encouragement in years. (OGJ, Jan. 18, p. 63). Frome-Broken Hill is now testing zones higher in the well. The test is located on the south coast of Australia, in Victoria province.

Mozambique's first refinery will be built by Procon (Great Britain), Ltd., under a contract for Sociedade Nacional de Refinacao de Petroleos at Lourenco Marques, East Africa. Refining units will include a 12,000-bbl. crude unit, 2,500-bbl. Platforming unit, a 2,000-bbl. diesel fuel Unifining unit and a 1,500-bbl. Merox unit. Completion is scheduled early in 1961. Crude will be supplied from Middle East fields.

Russia is resorting to the use of plywood pipe for flow lines in Baku oil fields. The pipe is made in diameters from 2 to 12 in., and helps avoid delays caused by chronic shortages of metal pipe. Action of sulfurous crude on metal lines makes it necessary to replace them every 2 to 3 months.

A $10 million catalytic reformer is being installed at Abadan refinery by Iranian Oil Refining. The 20,000-bbl. unit will produce components for high-octane gasoline, enabling the big refinery to improve its competitive position in European markets. It will go into operation in 2 years.

Atlantic Refining has taken 80% interest in a 1,250,000-acre concession in Bolivia held by Drilling & Exploration Co. Atlantic exercised its option to acquire the rights by agreeing to drill a 11,000-ft. wildcat. The concession is located in the State of Santa Cruz. The well will be drilled 60 miles north of the city of Santa Cruz, and about 180 miles east of Cochabamba. The concession lies in a basin area on the east flank of the Andes Mountains. Atlantic's wildcat will test the Devonian.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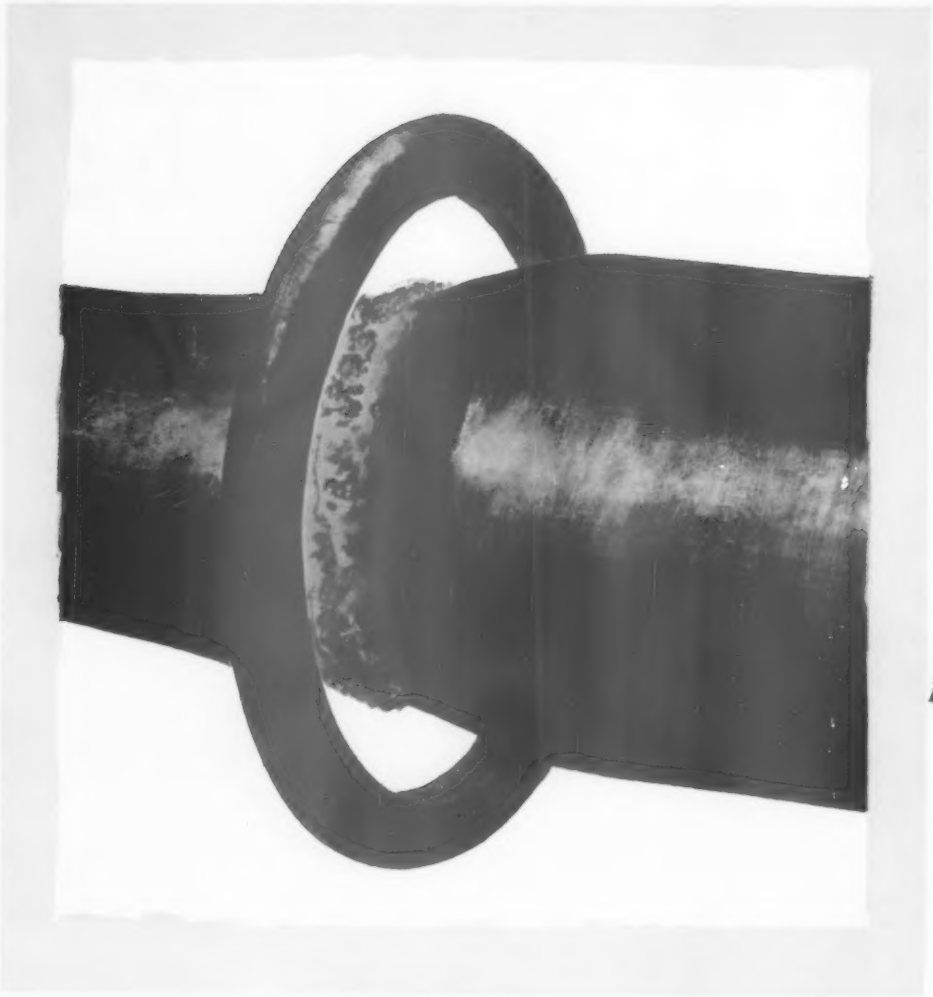

Magic Ring induction heat-treating more than doubles the impact strength of HUGHES "Flash-Weld" tool joint-to-pipe connections

Electronically-controlled inductor rings are used in the new Hughes heat-treating process to normalize and stress-relieve the weld area of "Flash-Weld" tool joint-to-pipe connections. This results in connections with metallographic uniformity across the weld never before available to the industry.

To fully evaluate the metallurgical properties obtained in the weld area by the new process, Hughes engineers developed the world's largest tension-impact testing equipment. A heavily weighted drillstem, dropped in a well and caught at the tool joint box shoulder in a steel anvil, subjects the welds to axial impact loads of more than 400,000 foot pounds. In more than 200 of these destruction drop tests—the severest to which welds have ever been subjected—not a single weld, heat-treated with the Hughes *Magic Ring*, was broken.

These important additions to the Hughes flash-welding process, plus other engineering and design features developed in unitizing more than 40 million feet of drill pipe since 1938, assure you the *most dependable* and *most economical* drillstem you can run in any well.

FLASH-WELD
A DEVELOPMENT OF
HUGHES TOOL COMPANY
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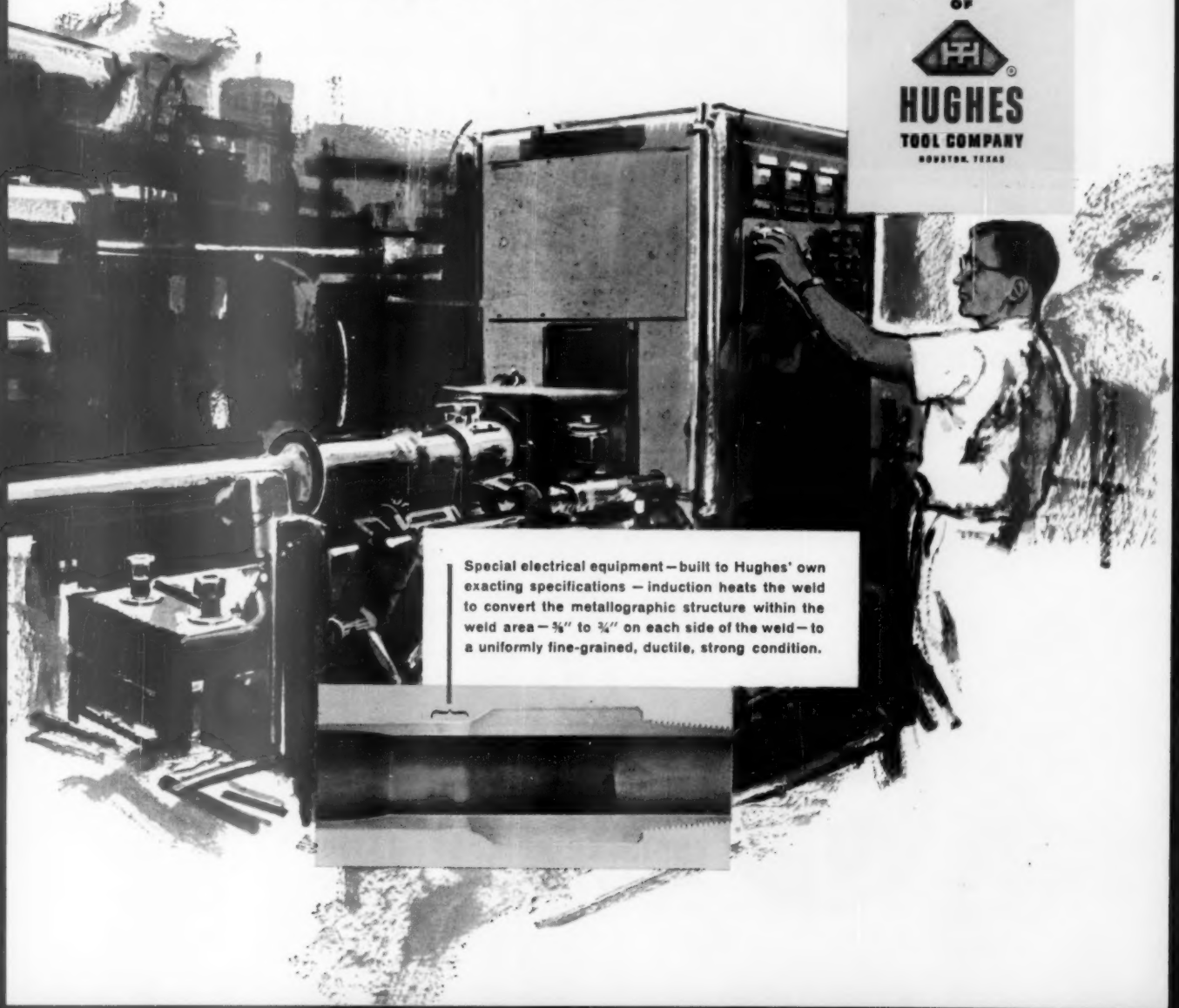

Special electrical equipment—built to Hughes' own exacting specifications—induction heats the weld to convert the metallographic structure within the weld area—⅜" to ¾" on each side of the weld—to a uniformly fine-grained, ductile, strong condition.

This flow-control valve—the key to SARGENT hydraulic pumping systems, the most efficient yet developed—is your key to production profit.

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4. Unrestricted application because the pump can be used on any well or on more than one well in group operations.
5. This pump has been operated on oil, salt water or fresh water as power fluid.

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If you are interested in "production for profit" use SARGENT.
Talk to your SARGENT Representative and learn how profits can be boosted by lowered "Installation-Maintenance" costs.

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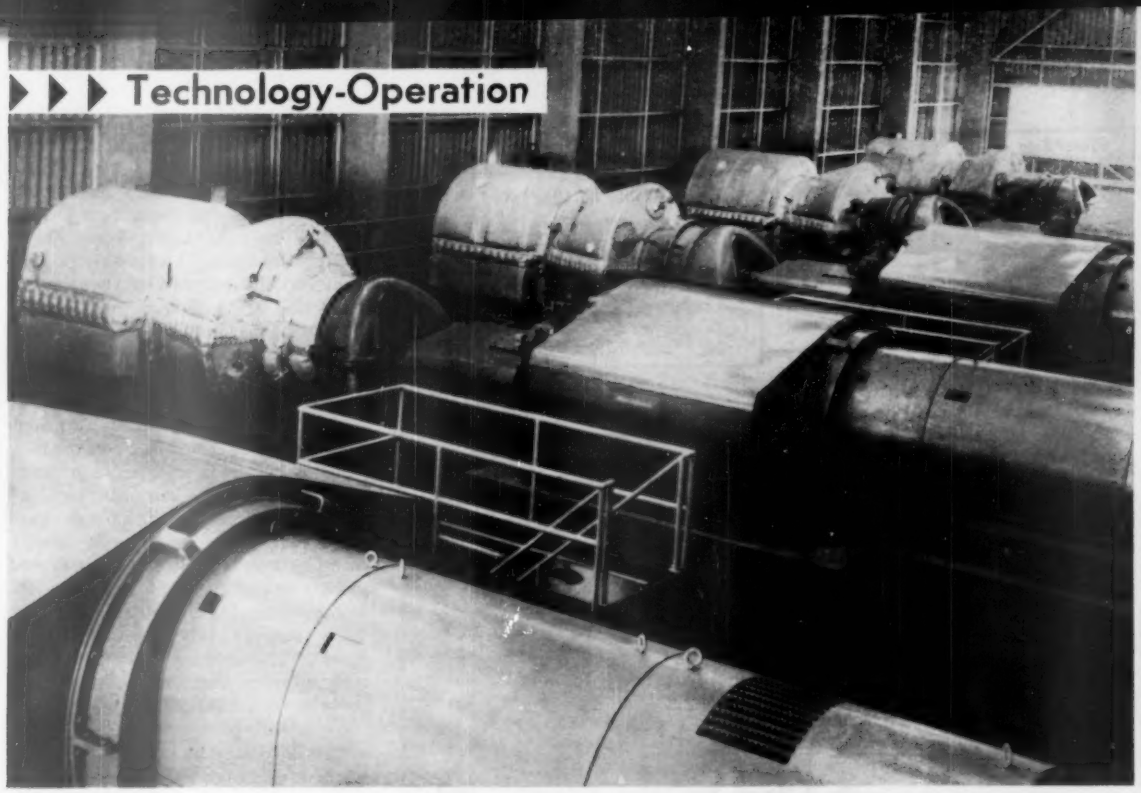


TURBINE ROOM of the electric-generating station at West Guara, Venezuela. This plant was built to overcome a lack of electricity and now . . .

Mene Grande generates own power

Exploration, production, and transportation requirements are satisfied by this $12,000,000 plant. Completely isolated, there are no interconnections with other power plants, and no power is bought or sold. Small alternate sources are located in pipeline pumping stations for standby use.

BY C. M. HONAKER
Mene Grande Oil Co.,
Barcelona, Venezuela
and
D. F. BRUCE
Westinghouse Electric Corp.,
Philadelphia

EARLY in the 1950's, Mene Grande Oil Co. was faced with the problem of providing power for its expanding facilities. By the end of 1951, its electrical load in the southern or Oficina area had been carefully limited to 2,300 kw. under peak conditions, with an installed generating capacity of 3,420 kw. and a firm capacity of 2,420 kw. At this time power was supplied by two plants, each having three generators driven by gas-fired internal-combustion engines, connected by a single-circuit 33-kv. transmission line. The major system load was Mene Grande's camp facilities, while loads totaling 9,000 kw., consisting of increments of 100 hp. or less were being powered by small internal-combustion engines.

Mene Grande's plans for future installation of gas injection, gasoline, water injection, and pipeline pumping plants made a study of anticipated power requirements and sources mandatory. The results of this study were very ably presented in a company report written by Hoyt Austin, dated March 31, 1952. The four alternatives evaluated were as follows:

1. Maintain existing facilities and install additional units as required to meet the loads as they developed.
2. Make arrangements with an outside party to build and operate a power plant with Mene Grande purchasing all necessary power from that source.
3. Build a suitable transmission line between the Greater Oficina, Anaco areas, and a stream plant located in Jusepin, State of Monagas.
4. Salvage existing facilities where possible and build one centrally located power plant sized for foreseeable demands and designed for simple expansion.

Plan 1, though flexible and capable of being closely coordinated with loads, was discarded because of the ultimate high capital investment and operational costs.

Plan 2 was considered unusable because at that time there were no operating companies interested in building power facilities for the purpose of the sale of large blocks of wholesale power.

The initial cost of a suitable double-circuit transmission line, with sufficient capacity for future capacity, involved in Plan 3 was estimated at $2,222,000. Moreover, the anticipated purchase price of power at the site of the steam plant was higher than the projected generation and transmission costs of a central power plant.

Presented at the annual meeting ASME, Atlantic City.

WEST GUARA was chosen as the site for the generating plant because of its central location in the area to be served. Gas and water are available in the area, and camp facilities are nearby.

With the elimination of Plans 1, 2, and 3, the need for a central power plant and system was justified. The problem was then narrowed to the choice of prime movers, location, and scheduling.

Choice of prime movers. The estimate of initial installation and operating costs for the three applicable prime movers was prepared and tabulated as shown in Table 1. The selection of gas turbines as prime movers was based upon low initial cost, low water requirements, and low operational and maintenance costs. The use of waste heat was considered and deemed not feasible because heat loads in sufficient quantity were not concentrated near the various prospective plant sites. The decision to use gas turbines was a bold one in that this plant was to be, and possibly still is, the only isolated generating station using gas turbines exclusively for prime movers.

Choice of plant site. The plant site at West Guara was chosen because of the availability of a suitable and plentiful gas supply without excessive pipeline facilities, nearness to camp facilities, central location with respect to anticipated future loads, and the availability of suitable water in limited quantity.

The original plant consisting of three 5,000-kw. turbogenerators and substation was completed in the latter part of 1955. A fourth unit was added in 1958 and the fifth was placed on the line May 1, 1959.

The central power system includes the central power plant and its substation; 144 miles of 69-kv. transmission lines; 13 miles of 33-kv. transmission; nine 69/13.8-kv. substations, one 69/2.4-kv. substation, and five 34.5/2.4-kv. substations. Four 69-kv. transmission lines leave the power-plant switchyard, two of which are radial feeders and two are looped feeders. Two additional 69-kv. lines radiate from points in the loop. Local power requirements near the central power plant are provided for by a 5,000-kva. 69/13.8-kv. transformer bank located in the power-plant switchyard. Major loads include camp facilities, water stations, pipeline pumping stations, gasoline plants, gas-repressurization plants and oil-well pumping units. Oil-well pumping accounts for an ever-increasing portion of the system load, at present totaling more than 13,000 connected horsepower. The maximum hourly gross generation to date has been 16,600 kw-hr.

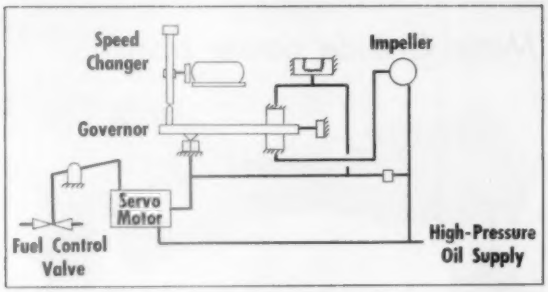
TABLE 1—ESTIMATED INSTALLATION COSTS

Item	Five 3,000 KW-gas-engine power plant	Three 5,000 KW-steam turbine power plant	Four 4,000 KW-gas turbine power plant
Gross capital plant	$ 3,675,000	$ 3,330,000	$ 2,900,000
Distribution system	800,000	800,000	800,000
Total investment	$ 4,475,000	$ 4,100,000	$ 3,700,000
Install capacity—KW.	15,000	15,000	16,000
Firm capacity—KW.	12,000	10,000	12,000
Cost installed capacity	$ 245/KW	$ 220/KW	$ 181/KW
Estimated operating cost including depreciation	$.00946/KWH	$.00793/KWH	$.00711/KWH
Estimated Distribution costs	$.00063/KWH	$.00063/KWH	$.00063/KWH
Estimated total cost/KW.	$.01009	$.00855	$.00774

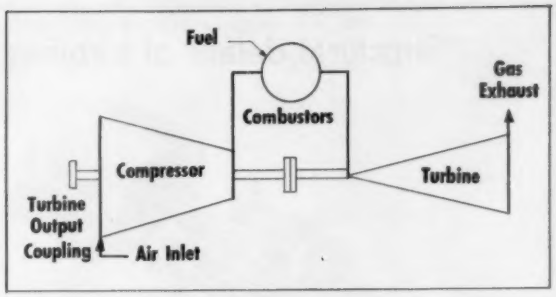
Central power plant. Although the original plant contained only three gas turbogenerator units, the design included provisions for simple expansion. The unit theme was followed throughout with each turbogenerator having its own gas compressor, cooling tower, stepup transformer, station service transformer, and generator oil circuit breaker. The generation voltage is 4,160 stepped up to 69 kv. by unit transformers and fed to the 69-kv. station bus through unit generator oil circuit breakers. The substation is equipped with a 69-kv. transfer bus and spare oil circuit breaker arranged so that substitution for any generator or feeder breaker can be accomplished.

The two buildings, main plant building and compressor building, are simply designed. The lower turbine-room floor at ground level is of concrete; and the main turbine room and compressor-building floors are made of steel grating. The building is divided into standard bays so that additional units can be housed by simply adding one or two bays on the end of the existing main building.

Fuel supply. Primary source of fuel is gas from the West Guara gasoline plant located nearby. Incoming gas at 45 psig. is compressed to 200 psig. by electric-motor-driven reciprocating compressors and routed through aftercoolers and three receiver tanks to the turbine-supply header. The three receiver tanks have sufficient volume to supply the plant for 30 seconds during emergency cutovers. Each turbine has its own surge tank located between its gas regulator and turbine inlet. Downstream pressure is regulated to 160 psig. at each unit.



SPEED is governed by this fuel-control system. The speed changer alters the load on the governor spring, and the servo motor changes position of fuel-control throttle valve.



TURBINES used to drive the electric generators operate on a typical thermodynamic cycle as shown in this sketch. Flow of air and fuel is from left to right in the drawing.

Liquid elimination is accomplished by gas-compressor-inlet separators, aftercooler and receiver trap drains, final heating to 120° F., and surge-tank blowdowns.

An alternate gas source, regulated to 45 psig., is supplied to the gas-compressor inlet header by a local field system. Automatic cutover, during failure of the primary gas supply, is accomplished pneumatically with manual reset. Recently a second alternate gas supply has been added to improve reliability during emergencies. Gas at 1,500 psig., by direct pipeline from two injection wells, is reduced to 180 psig. and tied into a header between the gas-compressor discharges and the receiver tanks. This "floating" supply is so regulated that it cuts in on a compressor-discharge pressure drop to 180 psig. and cuts out on a discharge pressure rise to 200 psig.

Water supply. Plant water for cooling and miscellaneous purposes is supplied by pipeline from water wells located in Mene Grande's San Tome camp. Originally each turbogenerator unit was provided with a natural-draft cooling tower and circulating water pump discharging into common turbine supply and outlet headers. A deviation from unit design was made during the last plant extension in order to eliminate excessive drift. At this time two forced-draft cooling towers were installed, each sized to supply the coolant needs of three generating units. In the future, the natural-draft towers will be used for standby only.

Emergency startup power is provided for by a 2,400-volt generator driven by a reciprocating gas engine. This equipment was salvaged from the original generating stations, and has proven the least reliable part of the plant.

Direct-current control power is supplied from one 120-volt Plante style station battery equipped with a selenium-rectifier charger. Future plans include the installation of a Ni-Cad battery and motor generator set to supply control power for the fourth and fifth units.

All controls, with the exception of push-button stations for gas compressors, cooling-tower fans, and circulating-water pumps are centrally located in the air-conditioned control room. Included are remote controls for the pneumatically operated 69-kv. oil circuit breakers and remote controls for the turbine-generators, in addition to the 480-volt switchgear for the station auxiliary equipment and the turbine-generator units. Although all 440-volt station service buses are linked by circuit breakers there is no provision for synchronization as regards the auxiliary buses. Therefore, all sections are protected from dual feed by interlocks. Auxiliary equipment is driven by 440-volt motors.

Gas turbines. The gas turbines installed at this power plant are Westinghouse Model W-81G machines with a rating of 5,000 kw. each. Each unit is a self-contained power plant and can be fully loaded from a cold start in a matter of minutes.

The schematic diagram illustrates the thermodynamic cycle of the machines. Atmospheric air is taken in by the axial flow air compressor and compressed to 6 atm. Fuel is injected into the compressed air and burned in the combustor section. The hot gases are expanded through the turbine driving the axial-flow air compressor and the generator.

Availability and Reliability

On June 1, 1959, the central power plant had been in operation 38,944 hours with an accumulated 118,504 machine-hours. Availability for the five turbines installed is defined as follows:

Per cent availability = $(A + B \times 100)/(A + B + C)$ where (from Table 2).

A = total machine-hours of generation.

B = total machine—ready hours.

C = total machine—unserviceable hours—includes maintenance and inspection time and idle time while waiting for maintenance.

$$\text{Per cent availability} = \frac{(88{,}538 + 17{,}093) \times 100}{118{,}504} = 89.1$$

Reliability for the turbines is defined as follows:

$$\text{Per cent reliability} = \frac{X - Y \times 100}{X} \quad \text{(See Table 3)}$$

where

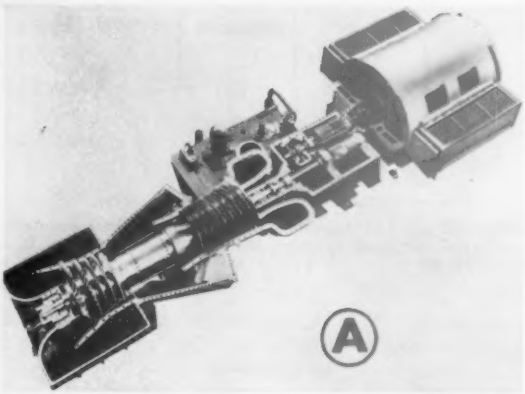
TABLE 2—TURBINE AVAILABILITY

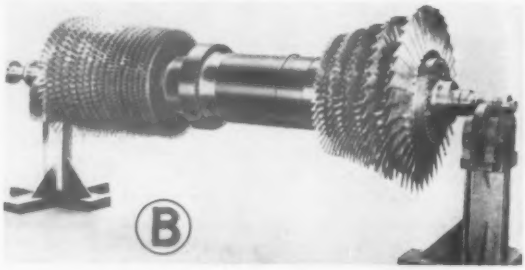
Turbine	Hrs. generation (a)	Hrs. ready (b)	Hrs. unserviceable (c)	Total
1	29,564	5,581	3,799	38,944
2	27,937	3,448	4,927	36,312
3	23,697	6,857	2,902	33,456
4	6,944	1,070	890	8,904
5	396	130	356	888

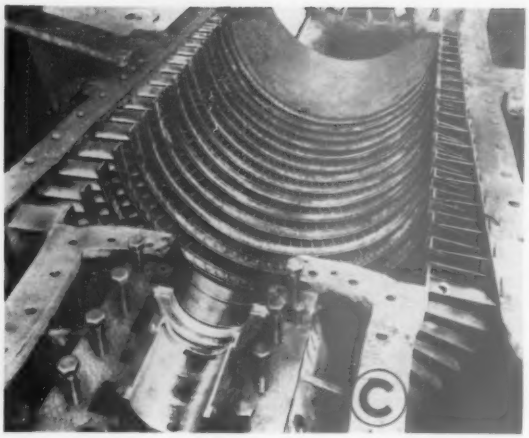
TABLE 3—PLANT OUTAGES CHARGEABLE TO TURBINE MALFUNCTION

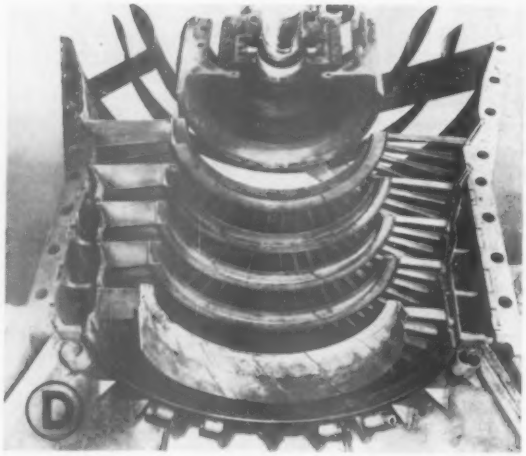
Date	Turbine	Duration (Hrs.)	Probable cause
April 15, 1955	2	0.17	Throttle valve servo-motor relay stuck
May 1, 1955	2	2.67	Faulty regulator of control air
October 17, 1955	3	0.17	Dirt in control air filter
August 1, 1956	3	0.57	Dirt in control air filter
August 7, 1956	3	0.82	Dirt in control air filter
February 25, 1957	3	0.72	Throttle valve servo-motor relay stuck
December 26, 1958	4	0.80	Unknown
	Total	5.92	

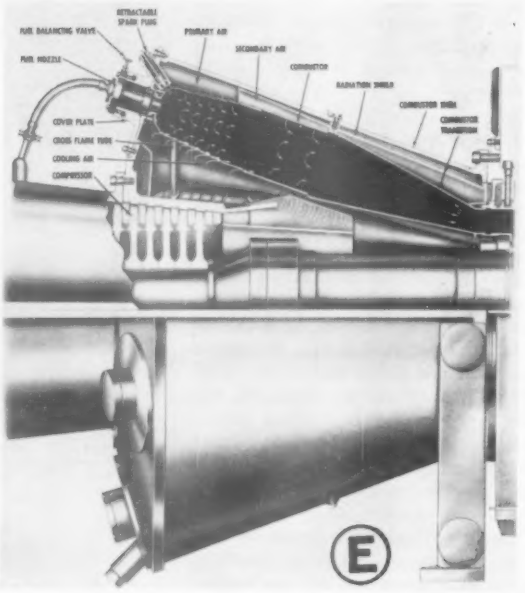
Structural details of turbines in Mene Grande power plant











A is a shop-test view of a turbine of type used in the Mene Grande installation. It illustrates the horizontal split single casing, and the two-bearing construction.

B is the rotating element. The axial compressor part is on the left and the turbine part is on the right. They are connected together by the torque tube to form a single rigid shaft.

Compressor portion of rotor consists of separate disks, one per stage, shrunk on a shaft. The rotating blades are forged from 12% chrome steel with machined dovetailed roots. These fit into slots broached around the periphery of the disks.

Blades of turbine portion of assembly are forged from Inconel X material.

C shows lower half of axial-flow compressor casing which is split on the horizontal centerline. Stationary blades are rolled, twisted airfoil sections of 12% chrome steel.

Lower half of turbine casing is shown in D. The five stationary rows of blades are welded into inner and outer shroud rings to form half diaphragms. The first four diaphragms are supported on separate stainless-steel rings which in turn are fitted into grooves machined into turbine casing.

E shows combustor section. Fuel is injected into six combustors which are conically arranged between compressor outlet turbine inlet. The single horizontally split casing houses and locates the combustors and their transition pieces. Fuel enters each individual combustor through a fuel nozzle and the necessary amounts of primary and secondary air are proportioned by the configuration of the combustor liner.

X = total installed plant hours (38,944).

Y = total hours' duration of forced plant outages chargeable to turbine malfunction.

$$\text{Per cent reliability} = \frac{(38{,}944 - 5.92) \times 100}{38{,}944} = 99.98$$

Automatic speed controls, load division, and bus-voltage controls are not incorporated in the present plant design. These features are being reviewed for possible installation at some future date. Speed and frequency are controlled manually, by the native operators, with little difficulty. Speed can be easily maintained within ± 0.2 cycle during normal operation and the machines can be synchronized smoothly. The turbines respond promptly to speed changes exceeding 0.06%. A master clock, checked daily by radio signal from the Bureau of Standards in Washington, D. C., is used as a base for comparison and control of frequency. Load division between turbines is adjusted manually by use of the speed changers.

An underfrequency relay set to close on frequency drop to 56 cycles guards against station overload. Presently, this relay trips all 69-kv. feeder breakers to reduce load. The advisability of using selective tripping on underfrequency is under consideration.

The 69-kv. station bus voltage is adjusted manually and no difficulty has been encountered in the division of reactive load between units or in maintaining bus voltage.

Operating Costs

Gross generation from the startup of the central power plant to April 20, 1959, totaled 264,267,923 kw.-hr. at a cost of $2,528,985 (includes maintenance, overhaul, and depreciation) or $0.00957 per kw.-hr. The cost breakdown for a representative year (1958) is shown in Table 4.

Repair and Maintenance Costs

Determination of the true cost of maintenance and repair alone is not possible owing to Mene Grande's accounting system as these are lumped together with operating expense. Table 5 lists the major turbine and generator parts that have been replaced since the plant became operational. No blading replacements have been made and none are anticipated during the second overhaul.

The itemized expense incurred during the overhaul of turbines 1, 2, and 3 in early 1957 is shown in Table 6. Gross generation up to that time totaled 92,229,100 kw.-hr. with 36,011 machine-hours.

TABLE 4—PLANT OPERATING EXPENSES 1958, GROSS GENERATION 84,050,000 KW.-HR.

Item	Amount	Cost $/Kw.-hr.
Labor and transportation	$ 97,934	0.00116
Fuel gas	212,519	0.00253
Maintenance materials and labor	52,616	0.00063
Overhead	5,565	0.00007
Depreciation	323,698	0.00385
Total	$692,332	0.00824

TABLE 5—MAJOR TURBINE AND GENERATOR REPAIR PARTS USED TO DATE

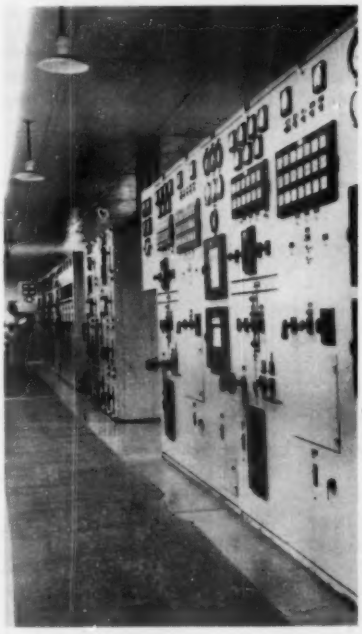
No.	Item	Unit cost	Total cost
12	Combustor basket	$1,077.57	$12,930.84
2	Transition piece	1,267.11	2,534.22
0	Exhaust bearing		
1	Compressor bearing	538.20	538.20
2 Set	Pinion bearings	737.10	1,474.20
1 Set	Exhaust turning vanes	500.00*	500.00
1	Taylor transmitter	549.90	549.90
1	Hagan thermostat	643.50	643.50
Estimated total			$19,170.86

TABLE 6—COST OF FIRST OVERHAUL (3 UNITS)

Item	Cost	$/Kw.-hr. generated
Labor and transportation	$12,788	0.00014
Service engineer	7,582	0.00008
Materials	3,104	0.00003
Machine shop charges	2,182	0.00002
Overhead and incidentials	2,215	0.00002
Total	$27,871	0.00030

Manpower Requirements

A complement of 11 nationals and 1 foreign plant foreman constitutes the normal work force at the central power plant. A regular shift consists of a control-room operator, who is responsible for plant operation during his turn and a gas-compressor-room operator. One mechanic is used exclusively for maintenance. The relief operators aid in maintenance work during the 3 days per week that they are nonoperational. Plant cleanup and general maintenance work is done by two laborers, who also substitute for operators during vacations, sickness, or emergencies.



WITH few exceptions, all control for the generating station are centrally located in this air-conditioned control room.

Turbine and generator overhaul has presented somewhat of a problem because of the lack of experienced men. At present overhaul is being accomplished by five men (one mechanic and four laborers, not part of the plant complement) in addition to the plant mechanics; under the supervision of a manufacturer's service engineer.

Future Plans

Plans for the immediate future do not include an increase in generating capacity. However, these plans are subject to frequent changes since they are dependent upon the marketability of oil. In the opinion of the authors, additional units will be identical to those already installed. A unit capacity of 5,000 kw. represents a reasonable increment of power both for loading and standby.

Identical units also alleviate the spare-parts problem in this remote area.

Design changes such as automation, the addition of a second plant battery, and selective feeder tripping on plant overload are constantly being considered. The basic plant design is considered sound, workable, and reliable.

Lab tests show that

CO_2 scores highest in reducing oil viscosity

Thus . . .

Production of viscous crude may be made more efficient by injection of certain gases that have a marked effect on crude viscosity and density. Laboratory studies show which gases are most effective at various concentrations and temperatures.

BY LEE R. DICKERSON AND GEORGE W. CRAWFORD
Texas Petroleum Research Committee, University of Texas

THE OCCURRENCE of viscous crude oils in large deposits of economic interest has generated interest in methods or techniques by which such deposits might be recovered profitably.

One possible method is the injection of gas into the reservoir to reduce the viscosity of the crude oil and to provide a drive mechanism. This application would depend upon the reservoir and reservoir fluid properties. If the net judgment encompassing all essential reservoir variables supports the use of gas injection, then the most important decision to be made is the selection of the gas to be injected. This decision can best be made as a result of laboratory investigation of the proposed gases in contact with the oil in question.

This article is concerned with the solubility of certain hydrocarbon and nonhydrocarbon gases in a medium-weight paraffin-base lubricating oil and with the viscosity of each of the resultant systems.

Procedure

Two-phase, gas-oil solubility and viscosity data were obtained in a series of constant composition runs in which three different weight percentages of each gas (carbon dioxide and ethane) were tested in turn with heavy engine oil at temperatures of 80°, 100°, 130°, 160°, and 200° F. The compositions selected were 1, 2, and 4% gas, by weight, of the amount of oil charged to the system.

A sample of known weight was charged into a visual cell (Fig. 1) and its volume determined at 80° F. This was subtracted from the volume of the cell to yield the volume occupied by the gas phase.

The cell was evacuated to a pressure of 100 μ of mercury. The required amount of gas, 1% by weight, was then transferred from a separate cell into the visual cell. A magnetic pump was used to circulate the gas through the oil until equilibrium was established. At this condition, the pump was turned off and final readings of pressure, temperature, oil level, and indicated viscosity (Ultraviscoson reading) were recorded. The thermostat was reset to 100° F. When temperature, pressure, and Ultraviscoson readings stabilized, saturation equilibrium values were recorded at the new temperature. Similarly, data for the 1% gas-oil system at 130°, 160°, and 200° F. were obtained.

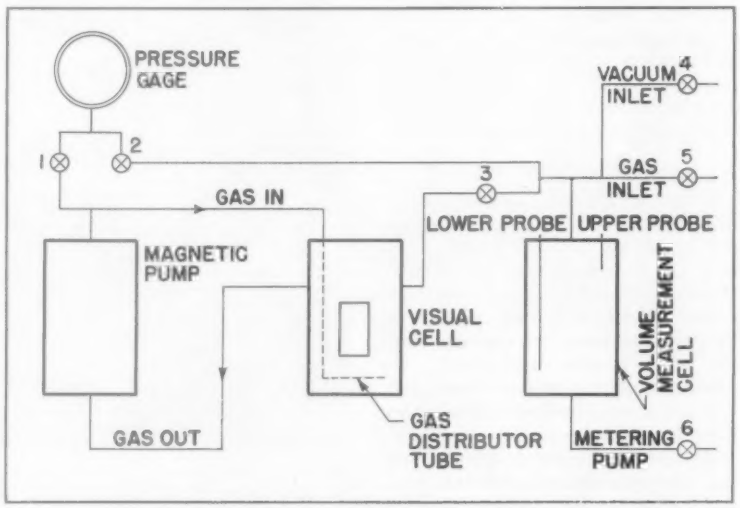
After the 200° F. readings were taken, the system temperature was returned slowly to 80° F. where the readings of pressure, temperature, oil level, and Ultraviscoson reading were repeated. These latter values checked the values previously taken at 80° F.

The system composition was next increased to a 2% gas by weight, and the procedure outlined above was repeated. Data were likewise obtained for a 4% gas system.

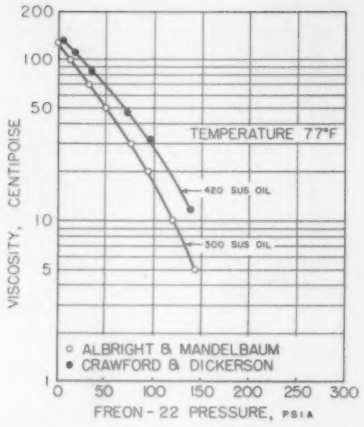
After this series, the oil was changed for the start of another series using a different gas.

Viscosity and Solubility Calculations for the Two-Phase Systems

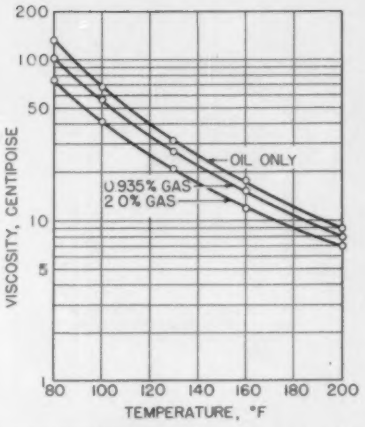
At each temperature point the oil density was required to convert Ultraviscoson readings to absolute viscosity in centipoises. In the swelling of the oil two factors contributed: temperature and gas in solution. In determining the true density of the oil at any temperature, it was necessary to add the weight of gas in solution to the base weight of oil charged. The amount of gas in solution was determined at each saturation temperature point as the difference between the weight of gas charged into the system and the weight of gas appearing



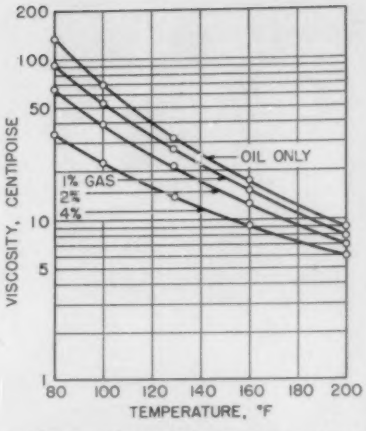
APPARATUS used in the solubility-viscosity tests. Fig. 1.



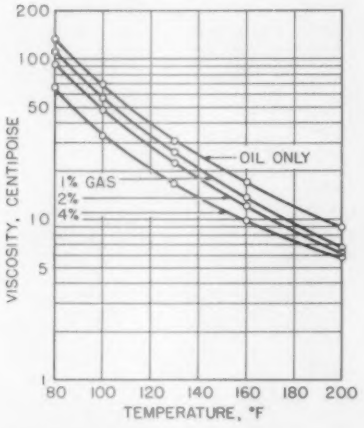
VISCOSITY - PRESSURE relationship for Freon-22 and oil. Fig. 2.



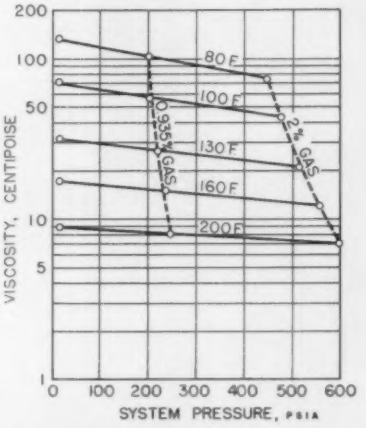
VISCOSITY-TEMPERATURE characteristics for methane-oil system. Fig. 3.



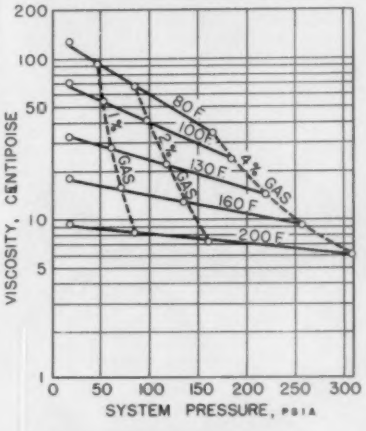
VISCOSITY-TEMPERATURE characteristics for ethane-oil system. Fig. 4.



VISCOSITY-TEMPERATURE characteristics for CO_2-oil system. Fig. 5.



VISCOSITY-PRESSURE characteristics for methane-oil system. Fig. 6.



VISCOSITY-PRESSURE characteristics for ethane-oil system. Fig. 7.

in the gaseous state. The oil used was a "dead" oil. Density and solubility were calculated by using PVT relations.

In order to secure data covering a wide range of gas molecular weights, the complete series of two-phase runs was originally planned for hydrogen. The series was not completed as the amount of hydrogen which went into solution in the oil was small and oil viscosity reduction was negligible.

Helium was substituted for hydrogen but it was only slightly soluble in the oil and had very little effect on viscosity.

A system composition of 0.935 wt. % methane was run, followed by the 2% composition. The 4% two-phase system could not be run as the pressure would have exceeded the probe limitation of 1,000 psi.

A run was made with heavy engine oil and Freon-22 at a fixed temperature of 77° F. in order to duplicate data obtained by Albright and Mandelbaum.[1] The oil used by these investigators was a 300 S.U.s. paraffinic-base oil slightly less viscous than the 420 S.U.s. oil used in the current test. A plot of both curves is shown in Fig. 2. By multiplying viscosity values from the upper curve by the ratio of the S.U.s. values, 300/420, corresponding values on the lower curve were obtained, confirming equipment performance and operation.

Viscosity Results

Viscosity data were obtained with two-phase systems for methane, ethane, and carbon dioxide. These gases were found to decrease viscosity of the oil at all temperatures, as shown by Figs. 3, 4, and 5. Further, the viscosity decreased significantly in each case for a given temperature as the gas fraction of the system was increased.

Several trends may be seen. Greater percentage reductions in viscosity occur at the lower operating temperatures than at the higher temperatures, suggesting that at some high temperature the curves converge to form a

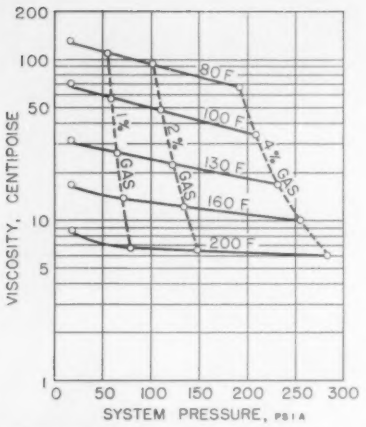
The authors conclude—

. . . Viscosity reductions as great as 60% can be realized by saturating heavy oil with various gases.

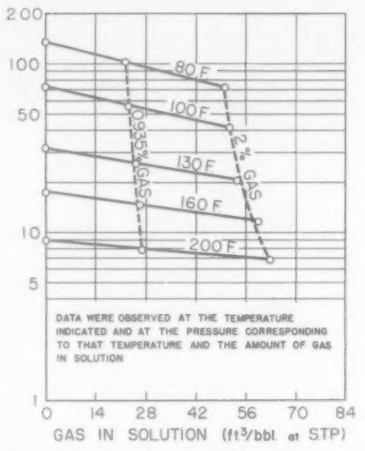
. . . At normal reservoir temperatures, 125° F. and above, carbon dioxide's effectiveness is equal to or greater than the influence of either methane or ethane.

. . . Carbon dioxide is retained in solution for a longer period of time after pressure reduction than are methane or ethane.

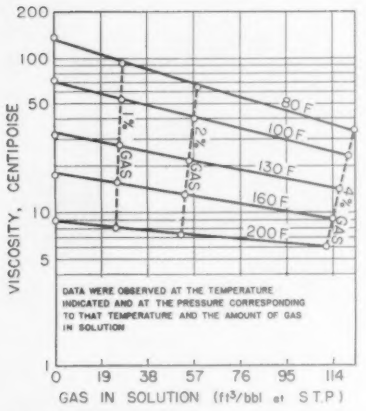
. . . Of the gases tested, methane and ethane are the most effective below 80° F.



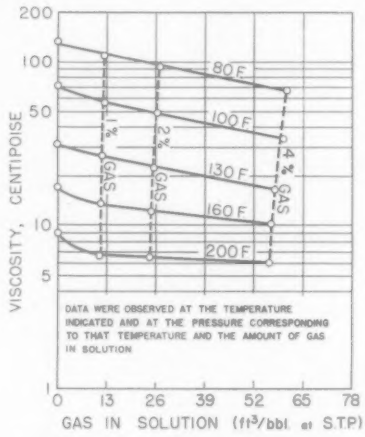
VISCOSITY-PRESSURE characteristics for CO_2-oil system. Fig. 8.


80 F
100 F
130 F
160 F
200 F
0.925% GAS
2% GAS
DATA WERE OBSERVED AT THE TEMPERATURE INDICATED AND AT THE PRESSURE CORRESPONDING TO THAT TEMPERATURE AND THE AMOUNT OF GAS IN SOLUTION
GAS IN SOLUTION (ft³/bbl at STP)

SOLUBILITY characteristics of methane in oil. Fig. 9.


VISCOSITY, CENTIPOISE
80 F
100 F
130 F
160 F
200 F
1% GAS
2% GAS
4% GAS
DATA WERE OBSERVED AT THE TEMPERATURE INDICATED AND AT THE PRESSURE CORRESPONDING TO THAT TEMPERATURE AND THE AMOUNT OF GAS IN SOLUTION
GAS IN SOLUTION (ft³/bbl at STP)

SOLUBILITY characteristics of ethane in oil. Fig. 10.


VISCOSITY, CENTIPOISE
80 F
100 F
130 F
160 F
200 F
1% GAS
2% GAS
4% GAS
DATA WERE OBSERVED AT THE TEMPERATURE INDICATED AND AT THE PRESSURE CORRESPONDING TO THAT TEMPERATURE AND THE AMOUNT OF GAS IN SOLUTION
GAS IN SOLUTION (ft³/bbl at STP)

SOLUBILITY characteristics of CO_2 in oil. Fig. 11.

single line along which viscosity is a function of temperature alone.

At any selected system composition, the viscosity decrease between plotted points is fairly constant. Of the three gases, ethane produced the greatest viscosity depression at the lower temperatures. At higher operating temperatures, the carbon dioxide produced the greatest viscosity change in the oil.

Viscosity versus pressure characteristics for the two-phase methane, ethane, and carbon dioxide systems with heavy engine oil, shown in Figs. 6, 7, and 8, plot as straight lines on semi-log paper. As may be seen on the curves, such extrapolations are in agreement with the dead-oil viscosity values although at higher temperatures some dispersion is apparent.

The viscosity versus saturation pressure plots obtained for all systems show that saturation pressures of equivalent system compositions vary inversely with increasing gas molecular weight and that the lower-molecular-weight gases of ethane and methane have greater influence on viscosity at lower temperatures. The range of pressures for the carbon dioxide-oil system, between the temperature limits 80° to 200° F., was 50 to 270 psia. For ethane, the range was 45 to 310 psia., and for methane, 200 to 580 psia. The operating temperature range was above the critical temperature for all gases used and no miscible liquid phases were formed.

Solubility Results

Figs. 9, 10, and 11 show, respectively, the solubility characteristics of methane, ethane, and carbon dioxide gases in terms of cubic feet per barrel of oil referred to standard temperature and pressure. Viscosity reduction varied directly with gas molecular weight at lower temperatures, while at temperatures above 130° F., some reversal in this order may be noted. As the gas concentration of a given gas-oil system was increased from 1% to 4%, the gas-in-solution decreased more sharply with increasing temperatures for the ethane-oil and the carbon dioxide-oil systems.

An exception occurred in the case of methane in which solubility increased with increasing temperature. Ordinarily, this behavior is not expected and, where present, usually indicates the presence of a pressure leak since gas lost from the gaseous phase is charged as gas in solution. The behavior was established, however, by a return.

Temperature and pressure increases operate in opposition in their effect on gas in solution. In the carbon dioxide and ethane systems, the net effect was always to evolve gas from solution. The methane-oil system proved to be an exception to the rule.

Density Changes

The density of heavy engine oil at 80° F. is 0.862 g. per cc. This value usually decreased at constant temperature with an increase in gas in solution. The lowest value calculated was 0.795 for the 2% methane-oil system at 200° F.

In the calculation of oil density, the weight of gas in solution was added to the weight of the oil, and the swelling effect due to temperature and gas in solution was included in determining oil volume.

Secondary-Recovery Applications

In the conclusions it was pointed out that at normal reservoir temperatures, carbon dioxide was effective in reducing the viscosity of oil in the same or greater degree than methane or ethane. One additional advantage that carbon dioxide has favoring its use in a secondary application is its high viscosity.

Flow model tests[2] in which oil has been displaced by a gas show conclusively that the width of the invasion zone and the regularity of the zone front are improved by the use of high-viscosity gases which maximize the viscosity ratios. By this criterion, carbon dioxide should have considerably greater sweep efficiency than either methane or ethane.

Acknowledgment

The authors thank Dr. George H. Fancher, director of the Texas Petroleum Research Committee, for his assistance in this work. Appreciation is expressed to the Texas Petroleum Research Committee for permission to publish the results.

References

1. Albright, L. F., and Mandelbaum, A. S., "Solubility and Viscosity Characteristics of Mixtures of Lubricating Oils and Freon-13 or 115," Refrigerating Engineering, Vol. 64 (Oct. 1956), p. 37.

2. Chatenever, Alfred; Indra, Mohit K., and Kyte, John R., "Microscopic Observations of Solution Gas-Drive Behavior," Journ. of Pet. Tech. XI (1959), 13.

A, B, C's of fluid flow

A LIQUID in motion will continue to flow unless the path of flow is blocked or until it has reached its own level. Therefore to move a liquid from one point to another, it is only necessary to provide a downgrade channel and the liquid will flow to the desired point. Water is supplied to cities from reservoirs in the mountains, without the use of pumps. The downhill grade from the mountains to the city is all that is necessary to move the water.

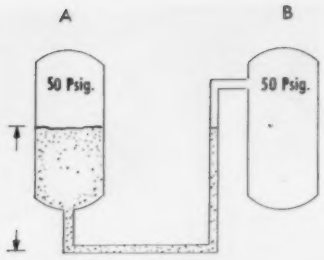
However, to move water from a reservoir in a valley to a town or city near the top of the mountain is another problem and approaches the type of problem in which we are most interested.

The movement of liquids and gases is of great importance in a refinery. Just look at any unit in a refinery and you will see that most of the parts of any unit are pipelines. These pipelines are the veins and arteries of a refinery.

Downhill grades for moving oil cannot be used in many refinery operations. The reason, of course, is that in many instances the flow of oils is from a low to a high-pressure point. To move a fluid from a low-pressure to a high-pressure location requires that external or mechanical pressure be applied to the fluid.

Fig. 1 demonstrates the necessity of applying mechanical pressure for a simple refinery operation.

Tower A has a bottoms level of 10 ft. Towers A and B operate at the same pressure. The refinery process requires that the bottoms from Tower A be transferred to the top of Tower B. As has been previously pointed out, a liquid will flow until some other force stops it or until it reaches its own level. In this case, there is no force stopping the flow and so the liquid will move from the tower into the line until the level in the line is the same as that in Tower A.



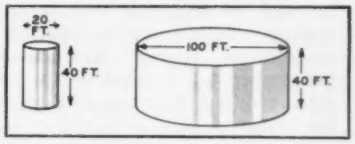
EVEN simple refinery operation uses fluid-flow principles. Fig. 1.

Since the process requires that the bottoms from Tower A be moved to the top of Tower B it is evident that mechanical or external pressure must be used in order to transfer this material. In some cases it might be possible to raise the pressure on Tower A; however in most refinery processes, we simply install a pump to take suction from Tower A and pump to the top of Tower B. In this way we not only move the liquid, but we move it at whatever rate we wish by regulating the operation of the pump or by using one of the various types of flow-control valves.

Here is a review quiz on principles of pressure

Please place a check (√) mark opposite the right answer.

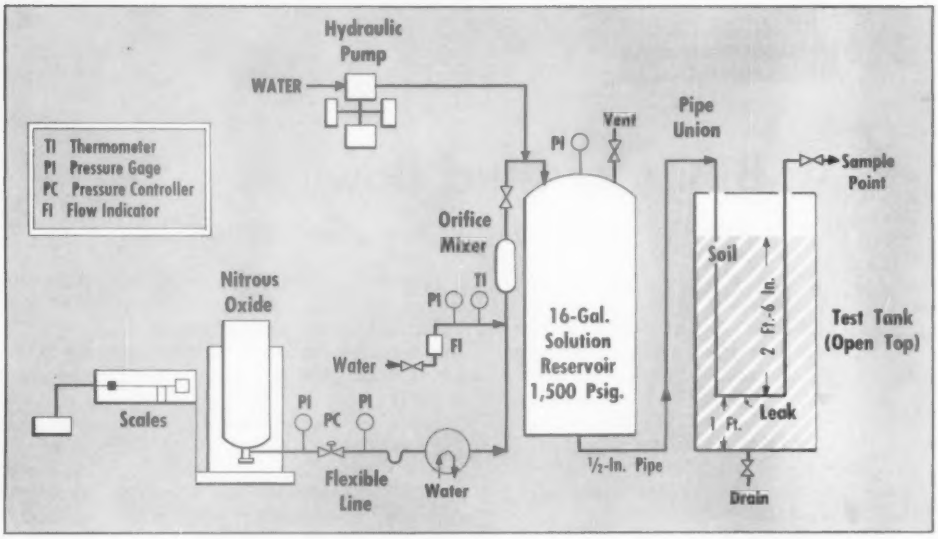
1. Pressure is
   - .... (a) How much a fluid weighs.
   - .... (b) The force or weight of a substance per unit area.
   - .... (c) The density of a liquid.
2. If more of a gas is pumped into a closed drum
   - .... (a) The pressure in the drum increases.
   - .... (b) The volume of gas in the drum increases.
   - .... (c) The weight of gas in drum decreases.
3. What is the pressure in pounds per square inch at the bottom of a tank containing water to a height of 10 ft?
   - .... (a) 14.7 psi.
   - .... (b) 144 psi.
   - .... (c) 4.33 psi.
4. A pump has a maximum discharge pressure of 43.3 psi. What is the maximum height that water can be pumped with this pump? (0 psig. suction)
   - .... (a) 43.3 ft.
   - .... (b) 14.7 ft.
   - .... (c) 100 ft.
5. A drum 25 ft. high is filled to 20 ft. with heating oil. A pressure gage on top the drum reads 125 psig. A pressure gage on the bottom will read
   - .... (a) less than 125 psig.
   - .... (b) more than 125 psig.
   - .... (c) 125 psig.
6. A tank 80 ft. in diameter has a roof area of about 5,000 sq. ft. As oil in the tank is pumped out the air vent plugs and the pressure inside the tank drops 1 psi. less than atmospheric pressure. Thus the pressure on top of the roof is 1 psi. greater than the pressure on the bottom side of the roof. This difference of pressure will cause an external force on the roof of
   - .... (a) 1 lb.
   - .... (b) 5,000 lb.
   - .... (c) 720,000 lb.
7. If the pressure on gasoline in a vessel is increased the boiling point of the gasoline will
   - .... (a) Go up.
   - .... (b) Go down.
   - .... (c) Stay the same.
8. If the pressure on a liquid is doubled the volume will
   - .... (a) Double.
   - .... (b) Become one-half as big.
   - .... (c) Stay about the same.
9. The two tanks shown below are both the same height and full of water. Which one is exerting the more weight against the foundation?
   - .... (a) The 20-ft. tank.
   - .... (b) The 100-ft. tank.
   - .... (c) They are both the same.



10. The two tanks of Question 9 are of the same height. Which tank will have the most pressure at the bottom when filled with water?
    - .... (a) The 20-ft. tank.
    - .... (b) The 100-ft. tank.
    - .... (c) Both tanks will have the same pressure.

ANSWERS

1.—b 2.—a 3.—c 4.—c 5.—b
6.—c 7.—a 8.—c 9.—b 10.—c



TEST APPARATUS includes facilities represented in the schematic diagram (Fig. 1), also shown in the adjacent photograph (Fig. 2), and the buried pipe at right (Fig. 3).

"Laughing gas" shows value in

Lab tests demonstrate feasibility of nitrous oxide tracer gas but much remains to be done to develop a suitable technique

SOUTHWEST Research Institute was engaged by Ohio Chemical & Surgical Equipment Co. to demonstrate if nitrous oxide mixed with water and injected into a pipeline will facilitate locating underground leaks in hydrostatic testing.

The principle involved is that gas released below ground will rise to the surface, where it can be detected by an infrared analyzer. Ohio Chemical has applied for a patent on the process, which it will license on a royalty-fee basis.

Five laboratory tests and one field test showed that the proposed technique was feasible. Surface concentrations of gas as low as 2 p.p.m. were detected. Concentrations of nitrous oxide checked were 0.05 to 0.37 volumes of gas per volume of water.

The initial cost of charging 10 miles of 30-in. pipe with 0.37 volumes of nitrous oxide per volume of water would be $2,500 to $3,500. It is believed that the time saved will, in many instances, more than justify this initial cost. Repeated reuse of nitrous oxide solutions will, of course, materially reduce the cost of nitrous oxide per mile of pipeline.

Problems which must be resolved to make the system a finished commercial method are: (1) Establishment of the required test concentration of nitrous oxide; (2) design of the equipment and method for sampling the air above the pipeline; and (3) means of producing aqueous solutions of nitrous oxide in the field in the required quantities and concentrations.

Leak-Detection Problem

The testing of pipelines is frequently a difficult and expensive task. For economic and safety reasons, pipelines must be leak-free. Hence, each pipeline must be tested for leaks at, or above, its expected operating pressure. In some situations, as in heavily populated areas or where it is required by local regulations, pipelines must be hydrostatically tested.

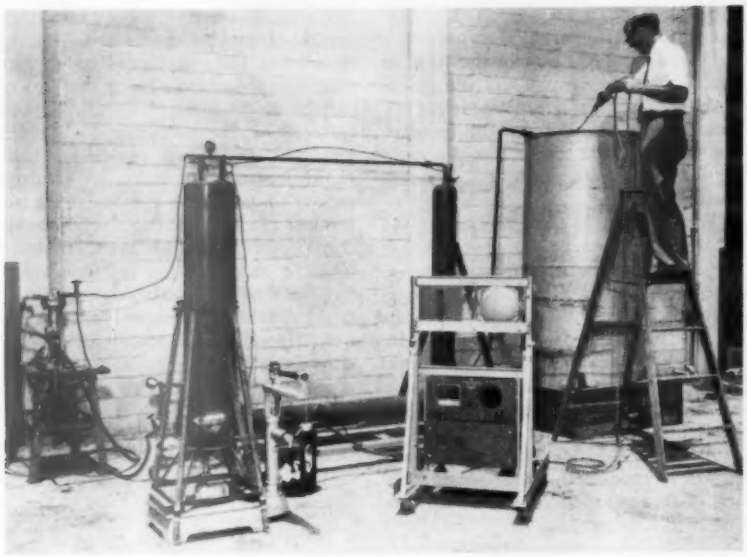
When a line is hydrostatically tested the presence of leaks is demonstrated by a drop in the line pressure. The location of particular leaks may be indicated by water shows. If a line under test is in an open ditch, leaking water can be easily seen in the bottom of the ditch. Many existing buried lines are tested and leaking water may, or may not, show at the surface of the ground.

In some formations water leaking out of a pipeline will drain down into the ground and will never show aboveground. In others, drainage may be lateral. In swampy areas, leaking water will just mix with the surrounding waters. From the foregoing, it may be seen that hydrostatic testing has some serious limitations.

Because of the commercial availability of highly sensitive gas detectors, the possibility of using gas tracers is quite attractive. Since nitrous oxide is water soluble and can be easily detected by infrared analysis it appears to fit into a convenient method for leak detection. Nitrous oxide is an ideal gas for testing leak testing, because it is nontoxic, noncorrosive, nonirritating, nonexplosive, and does not occur in nature. It is a man-made substance. Hence, it cannot be detected except where it has been deliberately liberated.

Tests with Tracer

General procedure used to test the leak-detection technique was to make



spotting pipeline leaks

in hydrostatic testing of underground lines, for underground application

BY JOHN E. KAUFMAN
Manager, Air Conditioning, Refrigeration, and Heat Transfer
Southwest Research Institute,
San Antonio

up a water solution of nitrous oxide and force it through an artificial leak in a pipe buried under 2½ ft. of soil in an open tank. While the nitrous oxide solution was being forced out of the pipe into the soil, the surface was scanned with the detector probe until a positive show of nitrous oxide was detected.

Solutions of nitrous oxide were made up at atmospheric pressure by adding the liquid material at a uniform rate to a stream of water flowing at a rate of 1 g.p.m. Mixing of nitrous oxide and water was accomplished by passing the combined streams through an orifice mixer. Sufficient solution was made up to supply the leak for almost 2 hours at the test pressure of 1,500 psig.

The artificial leak was a hole drilled in a length of ½-in. pipe oriented so that the leaking material would enter the soil bed in a downward direction. The hole was made with a No. 80 drill, 0.0135-in. diameter. It allowed 8.4 gal. per hour to flow out of the pipe.

When the system was filled with solution a sample was taken in such a manner as to exclude air. Then a pressure of 1,500 psig. was applied with a hydraulic pump, and the surface of the soil was repeatedly scanned with the detector probe until nitrous oxide was positively sensed.

Fig. 1 is a schematic diagram of the test apparatus and Fig. 2 is a photograph of the equipment. For convenience the solution reservoir was a U-shaped length of standard 6-in. pipe. This can be seen in the background of Fig. 2. The detector used

TABLE 1—LABORATORY TEST RESULTS

Test No.—	1	2	3	4	5
Nitrous oxide added, lb.	2.94	1.48	3.00	1.70	3.10
Water added, gal.	16	16	16	16	16
Nitrous oxide concentration (analytical) vol. gas/vol. water at atmospheric pressure	0.37	0.29	0.13	0.05±0.02	0.23
Test pressure, psig.	1,500	1,500	1,500	1,500	150-1,500
Soil condition*	Loose	Soaked	Packed	Packed and soaked	Loose
Leak rate, gal. per hour	8.4	8.4	8.4	8.4	2
Time to detect nitrous oxide, minutes:					
First show	4	4	4½	15	5
General	5	5½	5½	20	
Nitrous oxide detected, p.p.m.	5-100	2-100	5-15	2	¾-2½
Nitrous oxide released, lb./hour at 70° F., 1 atm.	0.048	0.038	0.017	0.007	0.007

*All soil used was the normal, sticky, black variety available on the Southwest Research Institute grounds.

was a standard infrared analyzer. Samples of air from the surface of the soil were obtained by a vacuum-sniffer-type probe at a rate of 20 cu. ft. per hour.

Five laboratory tests and one field test were run. The results of the laboratory tests are in Table 1.

The field test was run in the same fashion as the laboratory tests, except that the test section was a 20-ft. length of ½-in. pipe buried in a trench 1 ft. wide, 3 ft. deep, and about 20 ft. long. The pipe was buried in caliche typical of the San Antonio area. (This material is a dense, alkaline clay-type soil.)

The leak was located about midway along the buried pipe and it was pointed down. At 5 minutes after pressure was applied to the system 2 to 2½ p.p.m. of nitrous oxide in the air was detected at the surface. In 4 hours the concentration had increased to a range of 2 to 7½ p.p.m. in shallow surface indentations with the maximum concentrations detected closest to the leak. The observed test concentration was 0.1 volume gas per volume water. All traces of nitrous oxide in the test area had disappeared within 48 hours (see Fig. 3).

Results and Application

The objective of the work was to determine the feasibility of using nitrous oxide in solution as a tracer gas to find the existence and location of leaks in underground pipelines. As may be seen from the results shown in Table 1 and from the field test, the feasibility of such a technique has been demonstrated. Concentrations of nitrous oxide as low as 0.05 volume of gas per volume of water produced detectable surface concentrations and leak rates as low as 2 gal. per hour were sufficient.

Data obtained in the tests show that as little as 0.007 lb. of nitrous oxide can be released per hour and be detected at ground level by the infrared analyzer. A significant leak is defined in terms of economics and safety. If the maximum permissible leak for a given test situation were defined, then a nitrous oxide solution would be used for test so that it would release at least 0.007 lb. of nitrous oxide per hour.

Based upon a cost of nitrous oxide of 25 to 35 cents per pound, the cost of the gas for charging 10 miles of 30-in. pipeline with water containing sufficient gas to be detected from a leak of 8.4 gal. per hour would be $2,500 to $3,500, using 0.37 volume of gas per volume of water. It is possible, though, that this cost could be reduced to one-half or possibly one-quarter. However, if, as has been estimated, the cost of present hydrostatic testing can be as much as $1,000 per day, it is apparent that only 2½ to 3½ days' reduction in the time to find a leak could pay off the initial cost of charging a pipeline with nitrous oxide. In addition, the reuse of the nitrous oxide test solutions should be feasible. This would cut the cost considerably.

With regard to the function of the infrared instrument, it appears that the one used is a rugged and dependable instrument. The instrument is easy to operate. Whenever it indicated the presence of nitrous oxide by audio or visual signal it was found that the gas was indeed present. Other infrared analyzers are commercially available but were not tested.

Although the feasibility of the proposed technique for hydrostatic testing of underground pipelines using nitrous oxide tracer gas has been demonstrated, much remains to be done to develop a suitable technique for industrial application. Since the cost of nitrous oxide required is an important quantity, it is necessary to fix the least required nitrous oxide to insure rapid location of leaks. A positive means of preparing nitrous oxide solutions of specific concentrations in commercial quantities must be developed so that required test concentrations can be reproduced.

A suitable technique will be required to obtain samples of the air-gas mixtures at ground level above the pipelines. Sampling rates and probe geometry would have an important bearing on the concentration of nitrous oxide used. It is even possible that subsurface air samples would be required.

Computer shows high service factor

ON-LINE COMPUTER control has taken another stride forward with the completion of a 6-month test of a Daystrom, Inc., solid-state digital computer at Sterlington station (near New Orleans) of Louisiana Power & Light Co.

Sterlington logs show that the computer and data-logging equipment was in service 99.76% of the time over the 6-month operating period, 24 hours per day, 7 days a week. Maintenance personnel found that during the few times the equipment was out of service the trouble was not in the computer but in accessory equipment.

Heart of the system is an internally programed, single-address computer with a transistorized random-access magnetic-core memory.

The system will:

- Monitor 350 points involving process variables to determine whether they are within preset operating limits.
- Set off an alarm if these variables are found to be outside operating limits.
- Identify and locate the cause of trouble.
- Give a record showing time and location of the trouble, as well as the magnitude of deviation from normal.
- At regular intervals, print the value of each variable being monitored.
- On demand, type out every 12 seconds any measured or computed variable in its correct dimensional units.

On the basis of experience at Sterlington, the firm has announced that it will install a Daystrom control system at its new 230,000-kw. station at Little Gypsy, La., making it the first fully automatic utility installation in the country. The station is slated for service in 1961. Company officials say the equipment will continuously monitor 1,226 check points and automatically start, operate, and shut down the generating station.

BOOK

MINERALOGY, by Edward Henry Kraus, Walter Fred Hunt, and Lewis Stephen Ramsdell. Published by McGraw-Hill Book Co., Inc., 330 West Forty-Second Street, New York 36. 686 pp. $9.

This revised fifth edition is a comprehensive introduction to mineralogy; it deals with crystal and mineral forms. How to tell one crystal system from another and what physical features to look for in the various minerals are skillfully presented for the reader. Not only how and what to look for, but also the more abundant occurances of minerals are listed.

Separate chapters cover these topics among others: optical mineralogy, chemistry of minerals, physical properties, X-ray analysis, and blowpipe analysis—with procedures for field techniques in checking mineral types. Gemstones, including diamonds, are described and listed in one chapter.

Throughout the book are numerous diagrams, photographs, charts, and tables intended for the use of collectors, hobbyists, students, chemists, and geologists. This is an excellent handbook or text for anyone interested in the minerals of the world—their occurrance, distribution, and classification. This volume can be used in the field, laboratory, or the classroom.

Note: The Oil and Gas Journal maintains a book department. Write to the READER SERVICE DEPARTMENT, P. O. Box 1260, Tulsa 1, for copies of the book list. Often books reviewed here may be purchased from this source.

BY W. L. NELSON Technical Editor and Petroleum Consultant

How number of employes relates to size of company

THE NUMBER of employes of an oil company cannot be stated with precision because of the varied activities that are encountered such as marketing, drilling, exploration, research, etc. However, the number of workmen can be related to refinery runs, amount of oil produced and amount of gas produced, by means of empirical correlations as indicated in Fig. 1. The dashed 45° line of Fig. 1 represents the sum of (1) refining capacity, B/D/100, plus (2) oil production, B/D/50, plus (3) gas, s.c.f.d./400,000.

Small operators use slightly more employes than the formulation, whereas large companies use 2 or 3 times more employes. An attempt was made to introduce the effect of drilling activity but an examination of the triangle points of Fig. 1 indicates that contract drilling, etc., causes drilling activity to be an insignificant factor.

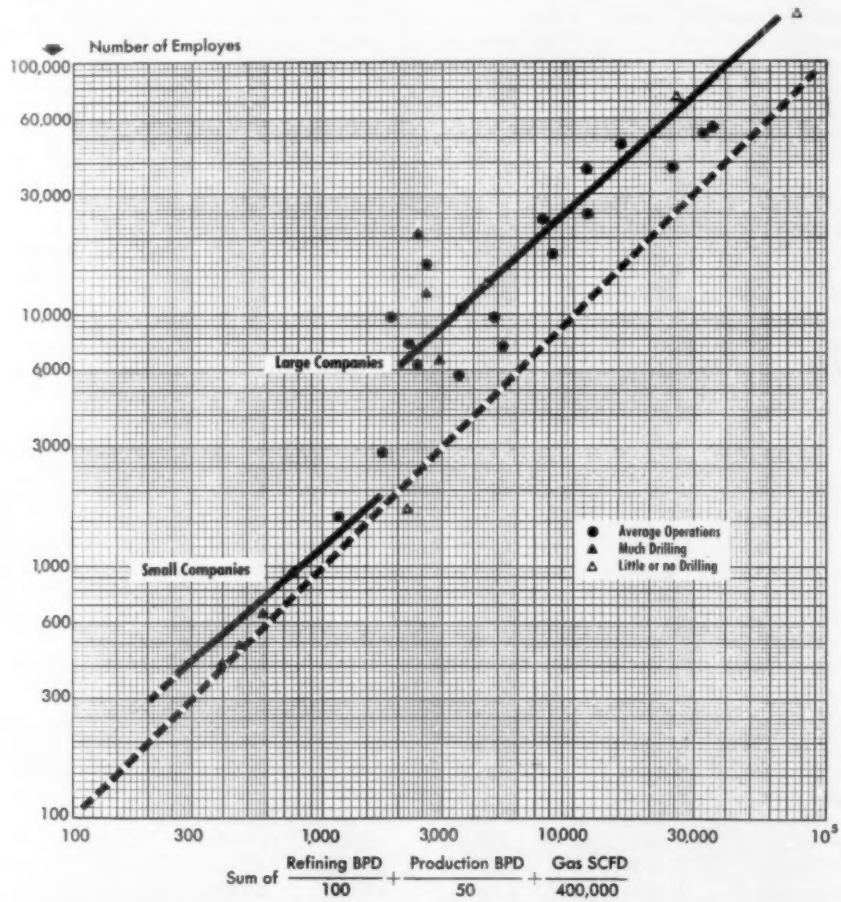
The several factors should not be considered separately as indications of the number of workmen used in each branch of the company operations because the workers of the head office (those used in sales, in drilling, in exploration, in research, and in marketing) are included in the several factors. The number of employes used in refining has been discussed in Process Costimating No. 41 (Feb. 16, 1959) and No. 44 (March 23, 1959).

Application of the empirical relationship stated above to several oil company operations, is indicated in Table 1.

TABLE 1—ESTIMATE OF EMPLOYES OF FOUR OIL COMPANIES

	A	B	C	D
Production, B/D	10,000	20,000	100,000	800,000
Refining capacity, B/D	20,000	6,000	60,000	1,500,000
Gas production, M.M.s.c.f.	None	30	1,000	2,500
Employes:				
From production	200	400	2,000	16,000
From refining	200	60	600	15,000
From gas	0	75	250	625
Total (by formula)	400	535	(2,850)	(31,625)
Total for larger companies*			*7,125	*79,062

*Larger companies use 2.5 times more workmen than the formula indicates.



TOTAL EMPLOYES of leading oil companies (1958) as a function of refinery runs, and gas and oil production. Fig. 1.

BY E. T. GUERRERO
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and
F. M. STEWART
Petroleum Engineer, Continental Illinois National Bank & Trust Co., Chicago

20. How to obtain and compare k_w/k_o curves from steady-state and laboratory unsteady-state flow measurements

GIVEN: Steady and unsteady-state water and oil relative-permeability data for the same core, Tables 1 and 2, and other data as follows:

L = length of core = 7.50 cm.
A = cross-sectional area of core = 7.89 cm.^{2}
S_{wm} = minimum interstitial-water saturation = 30.0%.
ϕ = porosity = 23.4%.
μ_w = viscosity of water at mean test conditions = 0.766 cp.
μ_o = viscosity of oil at mean test conditions = 1.20 cp.
W_d = dry weight of core = 178.8830 g.
W_w = water-saturated weight of core = 192.6580 g.
T_t = test temperature = 32° C.
ρ_w = density of water at mean test conditions = 0.9945 g./cc.
ρ_o = density of oil at mean test conditions = 0.7494 g./cc.
PV = pore volume = 13.86 cc.

Average test temperature = 32° C.
Viscosity of oil at mean test conditions = 40.1 cp.
Viscosity of water at mean test conditions = 0.768 cp.

FIND: Variation of water-oil permeability ratios, k_w/k_o, with water saturation by both steady-state and unsteady-state methods.

METHOD OF SOLUTION:
The equations which apply for steady-state conditions are:

$$k_f = \frac{\mu_f Q_f L}{A \Delta p} (1{,}000) \quad (1)$$

$$Q_f = \frac{\text{production of fluid}}{\text{time}} \quad (2)$$

$$S_w = \frac{PV - \dfrac{(W_w - W_d) - (W_e - W_d)}{\rho_w - \rho_o}}{PV}$$

or

$$S_w = \frac{PV - (W_w - W_e)/(\rho_w - \rho_o)}{PV} \quad (3)$$

And for unsteady-state conditions these are used:

$$k_w/k_o = \frac{(1 - f_o)\,\mu_w}{f_o\,\mu_o} \quad (4)$$

TABLE 1—STEADY-STATE LABORATORY DATA

(1) Run No.	(2) Production cc. Water	(3) Production cc. Oil	(4) Time, sec.	(5) Pressure drop, atm. p	(6) Weight of core, g. W_e
1	0.70	9.32	311.6	0.983	190.5363
2	1.93	8.04	331.1	1.020	190.8359
3	3.50	6.53	349.3	1.170	191.0360
4	5.78	4.22	343.2	1.240	191.2567
5	7.90	2.10	336.5	1.340	191.4252

TABLE 2—UNSTEADY-STATE LABORATORY DATA

(1) Measurement No.	(2) Oil prod., cc., ΔN_p	(3) Water prod., cc., ΔW_p
1	1.77	0
2	0.26	0.07
3	0.47	0.43
4	0.50	1.45
5	0.50	3.95
6	0.40	6.20
7	0.30	8.40
8	0.30	13.60
9	0.30	23.10
10	0.30	44.20

TABLE 3—CALCULATION OF WATER-OIL RELATIVE-PERMEABILITY RATIOS FROM STEADY-STATE LABORATORY DATA

Run No.	(7) Q_w = Water prod. ÷ Time (2) ÷ (4) cc./sec.	(8) Q_o = Oil prod. ÷ Time (3) ÷ (4) cc./sec.	(9) $k_w = \frac{\mu_w Q_w L}{A \Delta p}$ × 1,000 md.	(10) $k_o = \frac{\mu_o Q_o L}{A \Delta p}$ × 1,000 md.	(11) k_w/k_o = (9) ÷ (10)	(12) $\frac{W_w - W_e}{\rho_w - \rho_o}$	(13) S_w = PV − (12) / PV fraction	(14) S_w, % (13) × 100
1	0.00225	0.02991	1.67	34.71	0.0481	8.657	0.375	37.5
2	0.00583	0.02428	4.16	27.15	0.1532	7.434	0.464	46.4
3	0.01002	0.01869	6.23	18.22	0.3419	6.618	0.523	52.3
4	0.01684	0.01230	9.89	11.31	0.8744	5.717	0.588	58.8
5	0.02348	0.00624	12.76	5.31	2.4030	5.030	0.637	63.7

$$f_o = \frac{\text{Oil prod.}}{\text{Oil prod.} + \text{water prod.}}$$

$$= \frac{1}{1 + WOR} \quad (5)$$

$$S_{wd} = S_w \text{ avg.} - f_o W_i' \quad (6)$$

$$S_w \text{ avg.} = \frac{N' p}{PV} + S_{wm} \quad (7)$$

$$N_p' = N_p - 1/2\ \Delta N_p \quad (8)$$

$$W_i' = \frac{W_p + N_p - 1/2\ [\Delta N_p + \Delta W_p]}{PV} \quad (9)$$

Where:

L, A, S_{wm}, ϕ, μ_w, μ_o, W_d, W_w, T_t, ρ_w, ρ_o, and PV are defined with given data, and

k_f is effective permeability to flowing fluid of interest, md.

μ_f is viscosity of flowing fluid of interest at mean test conditions, cp.

Q_f is rate of flow at mean test conditions, cc./sec.

Δp is pressure drop across core, atm.

S_w is water saturation, fraction of pore volume.

W_c is weight of core containing oil and water, g.

k_w is effective permeability to water, md.

k_o is effective permeability to oil, md.

f_o is oil production, fraction of total production.

WOR is water-oil ratio, no units.

N_p is cumulative oil production, cc.

S_{wd} is water saturation at outlet end, fraction of pore volume.

S_w avg. is average water saturation in core, fraction of pore volume.

W_i' is cumulative water injected to middle of interval, pore volumes.

W_p is cumulative water production, cc.

N_p' is cumulative oil production to middle of interval, cc.

SOLUTION:

The solution is shown for the steady-state data in Table 3. Note that Table 3 contains columns start-

Table 4—Calculation of Water-Oil Relative Permeability Ratios By Unsteady-State Method

Run No.	(4) $\Delta N_p + \Delta W_p$ (2) + (3)	(5) ½ ($\Delta N_p + \Delta W_p$) = ½ (4)	(6) N_p, cc. = Σ (2)	(7) W_p, cc. = Σ (3)	(8) WOR = (3) ÷ (2)	(9) 1 + WOR (1) + (8)	(10) f_o = (1) ÷ (9)
1	1.77	0.885	1.77	0	0	1.000	1.000
2	0.33	0.165	2.03	0.07	0.269	1.269	0.7880
3	0.90	0.450	2.50	0.50	0.915	1.915	0.5222
4	1.95	0.975	3.00	1.95	2.90	3.900	0.2564
5	4.45	2.225	3.50	5.90	7.90	8.900	0.1124
6	6.60	3.300	3.90	12.10	15.5	16.50	0.0606
7	8.70	4.350	4.20	20.50	28.0	29.00	0.0345
8	13.90	6.950	4.50	34.10	45.3	46.30	0.0216
9	23.40	11.700	4.80	57.20	77.0	78.00	0.0128
10	44.50	22.250	5.10	101.40	147.3	148.3	0.0067

TABLE 4 (Continued)

Run No.	(11) $[1-f_o] \div f_o$ $[1-(10)] \div (10)$	(12) k_w/k_o = $(1 - f_o/f_o) \times (\mu_w/\mu_o)$ = (11) × (0.768/40.1)	(13) ½ ΔN_p = ½ (2)	(14) $\frac{N_p - ½\ \Delta N_p}{PV}$ [(6)−(13)] ÷ 13.86	(15) S_w = (14) + S_{wm} (14) + 0.300	(16) $W_p + N_p$ = (7) + (6) W_i
1	0	0	0.885	0.0639	0.364	1.77
2	0.2690	0.00515	0.130	0.137	0.437	2.10
3	0.9150	0.01752	0.235	0.163	0.463	3.00
4	2.900	0.05554	0.250	0.198	0.498	4.95
5	7.897	0.1512	0.250	0.234	0.534	9.40
6	15.50	0.2968	0.200	0.267	0.567	16.00
7	27.99	0.5360	0.150	0.292	0.592	24.70
8	45.30	0.8675	0.150	0.314	0.614	38.60
9	77.13	1.477	0.150	0.335	0.635	62.00
10	148.3	2.840	0.150	0.357	0.657	106.50

TABLE 4 (Continued)

Run No.	(17) (16) − (5)	(18) W_i' (17) ÷ PV	(19) $f_o W_i$ = (10) × (18)	(20) S_{wd} = $S_w - f_o W_i$ = (15) − (19)	(21 S_w, % (20) × 100
1	0.885	0.0639	0.0639	0.300	30.0
2	1.935	0.1396	0.1100	0.327	32.7
3	2.550	0.1840	0.0961	0.367	36.7
4	3.975	0.2868	0.0735	0.424	42.4
5	7.175	0.5177	0.0582	0.476	47.6
6	12.700	0.9163	0.0555	0.511	51.1
7	20.350	1.468	0.0506	0.541	54.1
8	31.650	2.284	0.0493	0.565	56.5
9	50.300	3.629	0.0465	0.588	58.8
10	84.250	6.079	0.0407	0.616	61.6

ing with (7). The first six columns are shown as laboratory data in Table 1. The same procedure was used in the case of the unsteady-state solution in Table 4, where three of its columns are shown as laboratory data in Table 2. The following is a sample calculation for the second row of data in each of Tables 3 and 4.

Steady-state:

$$Q_o = 8.04/331.1 = 0.02428 \text{ cc./sec.}$$

$$Q_w = 1.93/331.1 = 0.00583 \text{ cc./sec.}$$

$$k_o = \frac{(1.20)\,(0.02428)\,(7.50)}{(7.89)\,(1.020)}\,(1{,}000)$$

$$= 27.15 \text{ md.}$$

$$k_w = \frac{(0.766)\,(0.00583)\,(7.50)}{(7.89)\,(1.020)}\,(1{,}000)$$

$$= 4.16 \text{ md.}$$

$$k_w/k_o = 4.16/27.15 = 0.1532$$

$$S_w = \frac{13.86 - \dfrac{(192.6580 - 190.8359)}{(0.9945 - 7{,}494)}}{13.86}$$

$$= 0.464 \text{ or } 46.4\%$$

Unsteady-state:

$$WOR = 0.07/0.26 = 0.269$$

$$f_o = 1/(1 + 0.269) = 0.7880$$

$$k_w/k_o = \frac{1 - 0.7880}{0.7880} \times \frac{0.768}{40.1}$$

$$= 0.00515$$

The WOR is calculated using incremental production values occurring over an interval of time. It is necessary that S_w avg. and W_i' be calculated at the middle of the interval of time. Thus:

$$N_p' = N_p - \Delta N_p/2$$

$$= 2.03 - 0.26/2 = 1.90 \text{ cc.}$$

$$S_w \text{ avg.} = 1.90/13.86 + 0.300$$

$$= 0.437$$

$$W_i' = \frac{W_p + N_p - (\Delta W_p + \Delta N_p)/2}{PV}$$

$$= \frac{0.07 + 2.03 - (0.07 + 0.26)/2}{13.86}$$

$$= 0.1396$$

$$S_{wd} = 0.437 - (0.7880)\,(0.1396)$$

$$= 32.7\%$$

DISCUSSION: This problem shows the determination of water-oil relative-permeability ratios on the same core by two methods; steady-state and unsteady-state. The principal difference between the two methods is that the results from unsteady-state data vary with time while those from steady-state data do not. Of the two methods the steady-state has been the most frequently used. Equations 1, 2, and 3 show that the calculations are simple. It is considered reliable by many[1] but has the major disadvantage that several days to weeks may be required to perform the laboratory tests.

The data for the unsteady-state method can be obtained within an hour after the core is prepared. Equations 4 through 9 show that by comparison with the steady-state approach the calculation procedure is more involved.[2] In spite of this the unsteady-state method is more adaptable to routine core-analysis procedures. This is especially true if the calculations can be performed with a small or medium-size electronic computer.

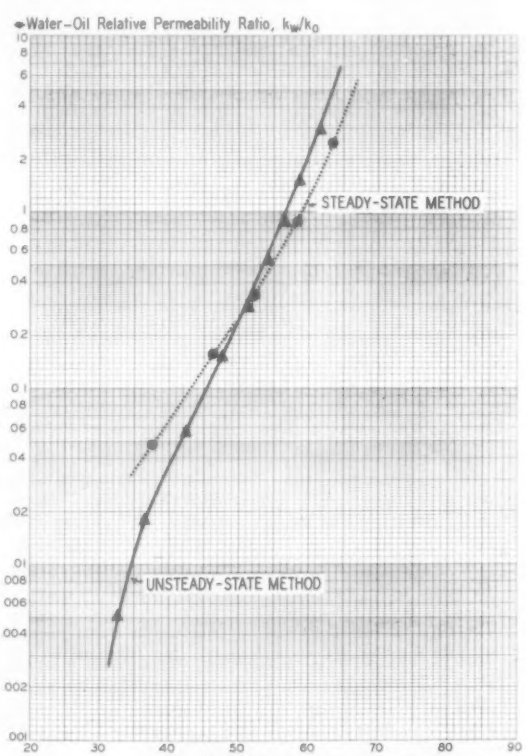
Do the two methods give comparable results? It is well to remember that in the steady-state method, fixed ratios of oil and water are flowed through the core until equilibrium conditions of saturation and pressure gradient are established. Data similar to those shown in Table 1 are then recorded.

In the unsteady-state method a core saturated with oil and interstitial (minimum) water is subjected to a water drive, and data similar to those shown in Table 2 are recorded. Both of these tests involve the same assumptions that were discussed for gas-oil relative-permeability determinations. Parts 18 and 19 of this series. Work performed by Lee[1] shows that the agreement between the two methods is not too good.

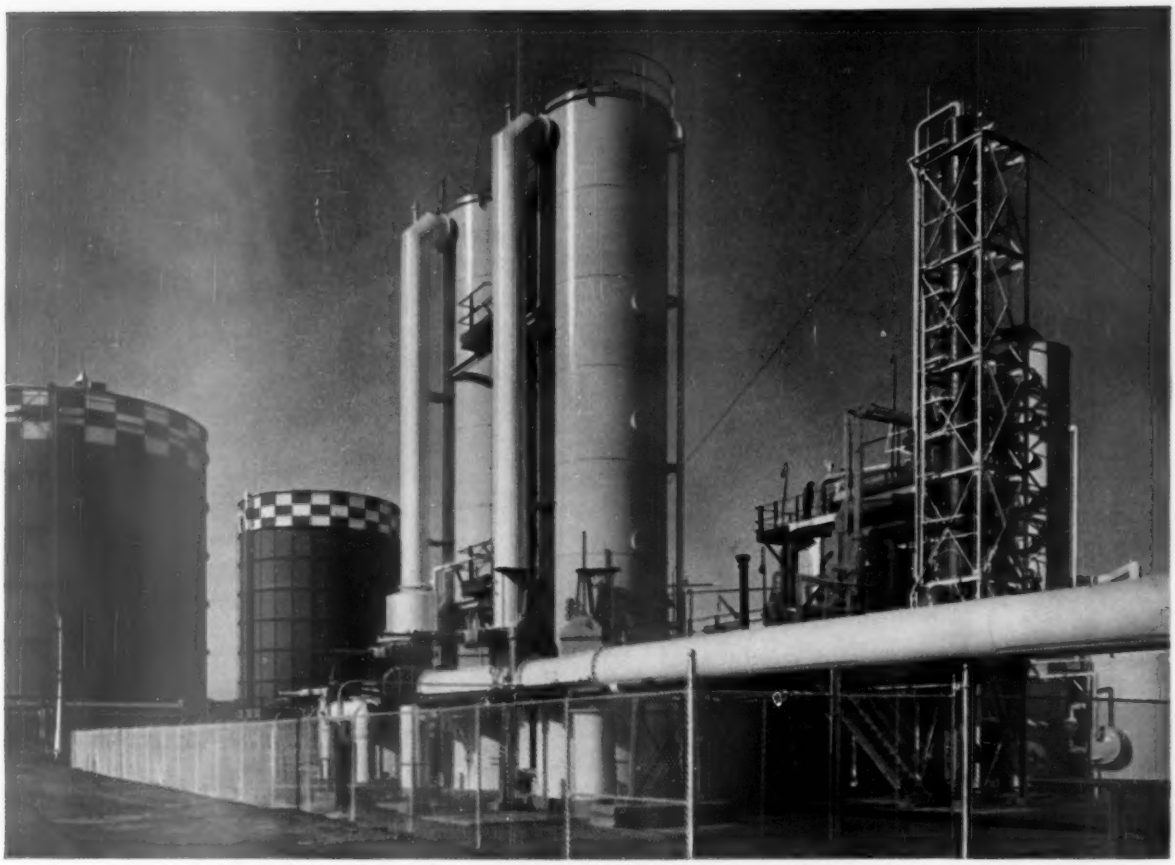
The results of this problem are in fair agreement over a large water-saturation range. Another thing to consider is that at least several curves would be required in order to obtain an average relationship for a lease or reservoir. Lee's[1] results show that the unsteady-state data may be both higher or lower than the steady-state data. Thus in the averaging of several curves compensation may occur and better agreement obtained. Furthermore, these data are used in the prediction of water-drive performance with other data, the reliability of which, may also be subject to limitations.

References

1. Lee, George C., "A Water-Oil Relative Permeability Ratio" unpublished thesis, University of Tulsa, 1957.
2. Welge, H. J., "Simplified Method for Computing Oil Recovery by Gas or Water Drive," Trans, AIME, 1952, 195.



THIS CURVE shows that the agreement in the results by the steady-state and the unsteady-state methods is fair, and probably within the limits of accuracy of some of the data used. It is believed that the accuracy justifies the use of the more approximate unsteady-state method to obtain results faster and cheaper.



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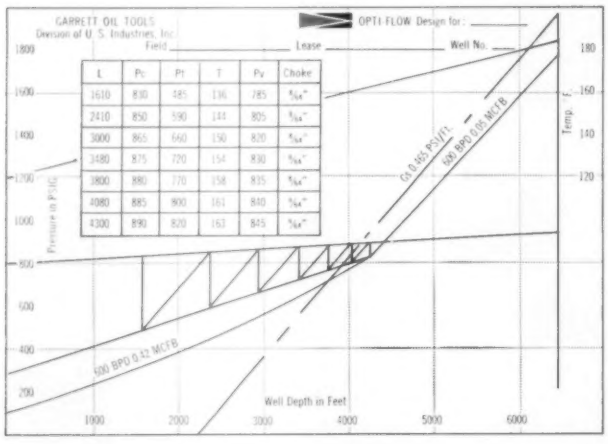

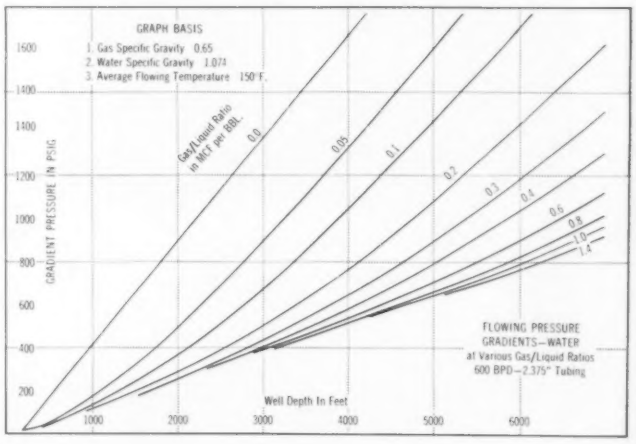

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Suppose we drilled a 50,000-footer

. . . could we produce it?

- Panel agrees it could be drilled now, with some changes in present-day equipment and methods. Servicing the well, and producing it, are almost out of the question now unless new materials are made available. If the well produces heavy oil, we are in real trouble.

A panel of experts in the fields of drilling, tubular goods, and production discussed the possibilities of drilling and producing a 50,000-ft. well at a forum luncheon of the Petroleum Activities Committee of the Mid-Continent Section of ASME. The panel members, and their fields of specialization were: Jack H. Abernathy, president, Big Chief Drilling Co. talked about drilling problems; R. L. Guernsey, field engineer for J&L Steel Co., discussed tubular requirements, and Harold S. Kelly, chief engineer, production department, Phillips Petroleum Co., Bartlesville, covered production problems.

NO ATTEMPT is made to thoroughly analyze drilling to 50,000 ft. Rather, an attempt is made to arrive at reasonable answers to a few selected problems. This is typical of the manner in which all questions should be examined should an ultradeep drilling operation be considered.

Casing. Certain assumptions are necessary as to the combinations of casing and hole size. Presently available sizes, weights, and grades are assumed wherever possible. The assumptions are arbitrary and various other programs could have been selected that would achieve the same end.

Routine operations would suffice for the shallow and protection strings, so they are given no consideration here.

The casing string shown in Table 1 was designed on the assumption that mud in the hole would weigh 18 lb. per gal. Mud of this weight (sp. gr. = 2.16) was assumed because sufficient hydrostatic head should be provided to compensate for the overburden pressure on the fluids contained in the rocks penetrated as well is drilled.

The table shows that if a casing program similar to the foregoing is used, maximum hook load occurs while running 9⅝-in. casing.

Drill pipe. To drill the 12¼-in. hole, 5-in. o.d. 19.50-lb. drill pipe would be used to approximately 20,000 ft. This is not far from present practice, as 9⅞-in. holes have been drilled to nearly 16,500 ft. with 5-in. o.d. drill pipe.

A practical tapered string at 50,000 ft. might be designed as shown in Table 2.

The calculated drill-pipe loads in Table 2 could be reduced by using lighter weights for part of the string for each o.d. size. For example, 4½-in. 16.60-lb. drill pipe might be used for most of the 4½-in. string and 3½-in. 13.30-lb. drill pipe would be satisfactory for most of the 3½-in. string. It is not considered necessary to refine the calculations to this extent for the present.

If P-150 material is available, at minimum yield the top joint can safely support a total of about 900,000 lb. The hook load in 18-lb. mud is 589,000 lb., thus about 310,000 lb. of minimum yield strength of the top joint of drill pipe is available for friction in the hole, safety margin, and fishing and working stresses.

Assuming 50,000 lb. of drill collars and wall drag of 100,000 lb. it can be seen that "free pull" at the bit is 160,000 lb. (Wall drag of 1 lb. per ft. of depth is normal for a hole which is free from rapid changes of direction and deviation.) Good present-day practice is to design for 100,000-lb. "free pull" at the top joint and at other points in the drill string where weights, grades, and sizes change. Thus an allowance of 160,000 lb. seems reasonable.

The load in mud at the top joint of 3½-in. 15.5-lb. pipe is seen to be 227,000 lb., equivalent to only 50,000 psi. Grade X-95 or P-110 pipe which is available in quantity would be satisfactory for the 3½-in. and 2⅞-in. portions of the drilling string.

Since P-150 casing is now a commercial product, no doubt drill-pipe manufacturers would be willing to fabricate possibly 10,000 ft. of drill pipe from this material for use on such an outstanding job as a 50,000-ft. test. If P-150 drill pipe is not available, by a careful design, by selection of best pieces from present-day P-110 material, (lab tests frequently indicate

TABLE 1—PROPOSED CASING PROGRAM FOR A 50,000-FT. WELL.

Hole size (in.)	Casing (in.)	Setting depth (ft.)	Est. wt. (air) (lb.)	Est. hook load in 18-lb. mud (lb.)
12¼	9⅝	25,000	1,250,000	800,000
8½	7*	35,000	†500,000	.....
....	...	.....	*400,000	.....
			900,000	600,000
5⅞	4-4½	*50,000	.....	.....

*Liner. †Drill pipe.

TABLE 2—PROPOSED DRILL-PIPE STRING TO TOTAL DEPTH OF 50,000 FT.

Size (in.)	Weight/ft. (lb.)	To depth (ft.)	Weight in air (lb.)	Weight in 18-lb. mud (lb.)
4½	20.5	25,000	510,000	362,000
3½	15.5	35,000	155,000	110,000
2⅞	11.0	50,000	165,000	117,000
Total			830,000	589,000

some lengths have minimum yields of 125,000 psi.) by shortening amount of 4½-in., and by increasing lengths of 3½-in. and 2⅞-in. strings, a fairly suitable drilling string might be assembled from contractors' and suppliers' stocks available today. From the tensile standpoint, use of 5 or 5 9/16-in. o.d. in the top of the string could be considered. However, more than three o.d. sizes would create complications of blowout-preventer hookups, etc., and from the analysis presented here, it is considered unnecessary to utilize additional o.d. sizes in the drilling string.

We turn now to a brief discussion of more important presently used equipment items and problems associated therewith. No attempt is made at a comprehensive analysis; a few are chosen to illustrate how the contractor will analyze each item and operating practice:

Hoisting and draw works. It can be seen that maximum anticipated hook load would be in the order of 800,000 to 1,000,000 lb. Several manufacturers offer, and a number of drilling contractors own and have in service today, draw works with a safe single-pull rating of 100,000 to 135,000 lb. Therefore hoisting and casing-running operations can be done with existing equipment using a maximum of 12-line reeving.

Auxiliary brake systems would be taxed to their limits while running casing.

One operating problem lies in the auxiliary brake system. Commonly used hydraulic or electromagnetic auxiliary brakes would not be entirely suitable in that too much friction-brake usage is probable. This would be especially true while running casing which cannot be lowered as rapidly as can drill pipe. One new type of magnetic-particle brake has only recently become commercially available. To date, operating results appear favorable, and brakes of this type may be adaptable to the indicated requirements. At any rate auxiliary-brake manufacturers, given a reasonable lead time, could no doubt develop equipment to meet requirements.

Wire rope. This is a critical link in the hoisting operation. Rated breaking strengths of available high-strength lines are:

1¼ in.	79 tons
1⅜ in.	95 tons
1½ in.	114 tons

The two longest lines, 1⅜ and 1½-in., have adequate strength for the loads expected, so there is no wire rope problem.

Trip time absorbs a larger percentage of total time as depth increases. A good rule-of-thumb estimate, based on experience, shows that with skilled crews and efficient equipment, round-trip time of ½ hour per 1,000 ft. of depth may be expected. We believe this rule holds to 21,000 ft. Of course, conditions down the hole often necessitate slower pulling, thus actual time for round trips may be much longer. Number of drill collars, weather, and other factors also make a great difference. At any rate, at a depth of 50,000 ft., trip time should be approximately 24 to 30 hours.

Pumping and hydraulics. Assuming 115 ft. per minute annulus velocity at maximum depth in 5⅝-in. hole, mud-circulating volume must be 110 g.p.m. Pressure losses in the system will be (18-lb. mud) about 4,100 psi.

The maximum horsepower requirement during the entire drilling operation occurs while cutting the 12¼-in. hole at 25,000 ft. just before setting 9⅝-in. casing. To circulate at 115-ft. per minute annulus velocity, 610 g.p.m. must be pumped. Assuming a tapered drilling string composed of 5-in.-o.d. to 20,000 ft. and 4½-in. to 25,000 ft., the pressure drop with 18-lb. mud would be about 5,190 psi. and 2,180 hp. would be required.

From the foregoing it can be seen that pumps must be capable of operating more than 5,000 psi. discharge pressure, and nearly 2,500 hp.

These data seem to indicate conditions for which pump manufacturers should plan. To date the basic concept in pump design has been for high horsepower (1,000 or more) at moderate (2,000-2,500 psi.) pressure ranges with large discharge volumes. Single-stage operations at 3,000 psi. can be done but at considerable cost for maintenance parts and pump down time. Ultradeep wells, however, need at limiting conditions only moderate gallonages and fairly high horsepower but must handle very high pressures. Compounding pumps in series may offer promise, but no experience has yet been had under actual drilling conditions at such high pressures.

The new multicylinder, single-acting pumps seem to offer several possible advantages, in theory at least.

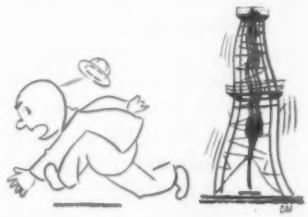
In general, it is felt that the pumping problem can be solved although at substantial cost.

Miscellaneous Items:

Examples of other items which require caution and thought are:

1. **Slips and elevators.** High-yield material is notch sensitive. Great care must be used in handling drill pipe and casing under the high-stress conditions expected. New developments in the line of double elevators, eliminating slips, offer a possible solution to the problem of handling the drill pipe. Casing handling will require considerable study.

2. **Derricks.** Derricks are made today of sufficient capacity to carry anticipated loads. Redesign in order to provide racking space for an ultradeep



Today's largest derricks would probably not collapse under the load of a 50,000 ft. well, but more racking space would be needed.

well would take considerable thought. The technical skills of the manufacturers, however, appear entirely adequate to allow the production of derricks to meet requirements.

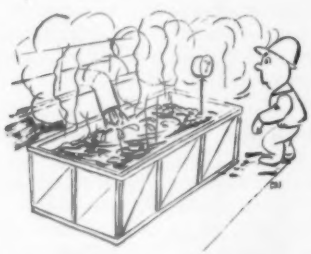
3. **Rotary table and swivel.** Present-day equipment has insufficient bearing capacity under rotating conditions and would require redesign with oversize bearings and load-carrying members.

4. **Blowout preventers.** No doubt with modifications, present-day equipment could be used, at least to the extent that the preventers could be expected to hold any stress the casing is capable of withstanding. High temperatures in return mud, however, could result in possible failure of gaskets and packing.

5. **Instrumentation.** Present-day weight indicators would probably prove insensitive owing to the dampening effect of wall friction. This might necessitate use of a slip-joint drive in the top drill collar thus insuring that

a previously determined bit load would be maintained.

6. **Drilling muds.** Mechanical refrigeration, a heat exchanger, or some other similar device would be required to reduce the temperature of the drilling fluid. If this were installed in the circulating tanks all equipment items in contact with the mud prior to cooling would require redesign for anticipated temperatures. Perhaps a method might be devised to provide cooling coils in the annulus between the 9⅝-



Mud returns from 50,000 ft. would be hot, and some method would be needed to lower the temperature.

in. and the surface casing. With bottom-hole temperatures of 700° to 1,000° F. return temperatures of 350° to 500° F. or more could be expected. Doubtless some form of oil-base mud or synthetic liquid would be necessary as it appears that water-base mud would be unsuitable.

7. **Drilling bits.** Present-day case-hardened bit teeth tend to soften at temperatures in the 450° F. range. Perhaps bit cutters could be made out of high-cost alloy materials to suit the requirements of the expected job, provided bit manufacturers are given adequate time.

While the foregoing discussion is more or less specific as to a 50,000-ft. test, it nevertheless illustrates a few problems the contractor must consider in preparing for a deep job today. Each item subject to weight, pressure, temperature, or stress from the bit to the crown block must be analyzed, the performance under expected conditions estimated, and if not adequate, appropriate substitution made.

Fortunately, in the past 15 years drilling contractors have developed technical staffs with a high level of professional competence. Given favorable geological conditions, from the contractors' standpoint a 30,000 or 35,000-ft. well could be drilled today with the best of today's equipment. However, testing, sampling, and completing ultradeep tests appear extremely difficult.

The tubular goods needed

A COMPLETE SET of tubular goods for a well consists of casing, tubing, and drill pipe. The problem now is to design the strings for a 50,000-ft. well.

Well conditions play an important part in the design of all of the pipe strings. Since these are not known for depths greater than 25,000 ft., known conditions must be projected to the 50,000-ft. goal.

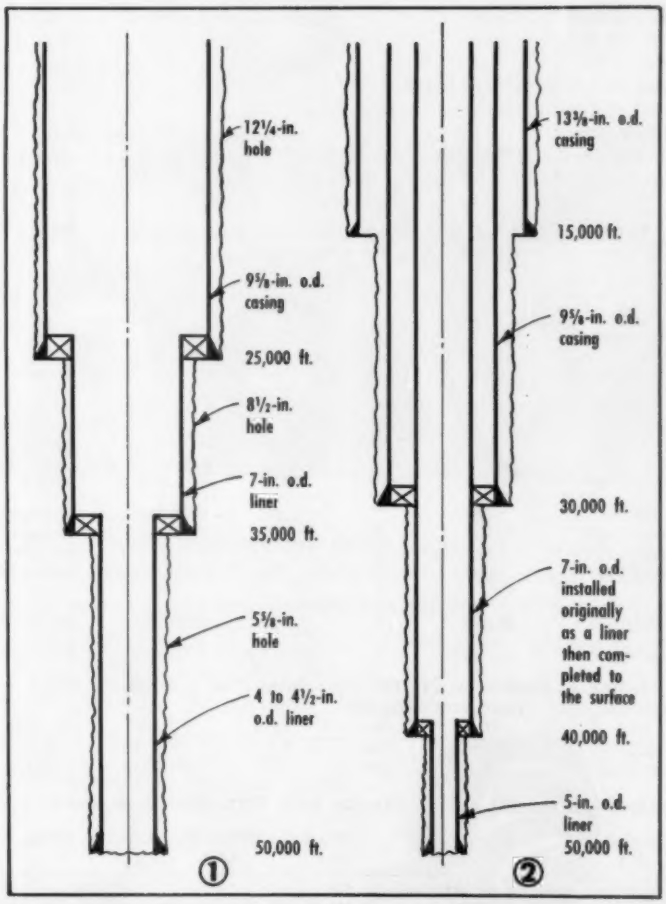
For purposes of calculation, it was assumed that bottom-hole pressure would be determined on the basis of a straight-line gradient of 0.8 psi. per foot of depth. Earth pressure gradient is about 1.0 psi. per foot of depth, and that for salt water is close to 0.5 so the 0.8 figure seems reasonable.

Applying this gradient, a bottom-hole pressure of 40,000 psi. can be expected at a depth of 50,000 ft.

Assuming a temperature gradient of 1° F. for every 62.5 ft. of depth, the temperature at the bottom of a 50,000-ft. well would be 800° F. Since temperatures up to this 800° F. level will have little effect on the mechanical properties of the pipe, the gradient was not used in design calculations.

Design factor. Record-depth strings that have been run in the past show that the design factors for deep wells are much lower than that normally required in published data. Lower design factors are being used and can be justified if conditions are closely supervised and controlled. By floating the pipe in the hole, and by maintaining the proper fluid level in the casing string, tension, collapse, and burst forces can be controlled.

One of the big problems is the design factor for collapse in the lower sections of the strings. When attempting to design with conventional safety figures, wall thickness and weights per foot get out of hand. Resistance to collapse of a given size pipe is not



At the left, No. 1, is the casing program proposed by Abernathy. That on the right, No. 2, is the one suggested by Guernsey. While differing, they both satisfy the requirements of the job.

noticeably increased by increasing the yield strength of the material. The best way is to increase the wall thickness, as this affects the familiar d/t ratio. Increasing the wall thickness is, in turn, undesirable because it increases the tension in the top section of the casing due to added weight, and it reduces the i.d. of the pipe in the bottom joints of casing.

Objectives. The requirements of the whole operation of drilling and producing a 50,000-ft. well were taken into consideration, and these objectives were established:

- Hole size at the bottom should be as large as possible.
- Derrick loads should be held to a minimum.
- Drill pipe should be as large as possible to provide high torsion strengths and good hydraulic characteristics.

String design. The calculations and tables used in the actual design of the casing strings made use of these design factors:

Tension, joint: 1.5.
Tension, body: 1.25.
Collapse: 0.5.
Burst: 1.1.

These design factors are justified on the basis of the following assumptions or considerations:

Tension, joint and body: The effect of buoyancy of the mud was taken into consideration, ultimate joint-strength values, and published yield strength values for the pipe body were used.

Collapse: It was assumed that the annular space was full of mud and that the casing being run was empty. The effect of tension on collapse was considered.

Burst: It was assumed that the annular space was full of mud, and that the casing was full of 0.55-sp.-gr. gas.

Mud weight: Calculations were based on 9.62-lb. per gal. mud for the 13⅜-in. casing and on 15.4-lb. mud for the other strings.

Table 3 shows the results of these calculations, and the completely cased well is shown schematically in Fig. 2.

No consideration was given to the setting of surface pipe since this is now a routine matter, even for deep wells. The first string considered was the 13⅜-in. casing to 15,000 ft. The next string was 9⅝-in. o.d. pipe run from the surface to 30,000 ft.

From the bottom of the 9⅝-in. casing to 40,000 ft., a 7-in.-o.d. liner was run. Using the liner reduced the load on the derrick, and kept the diameter of the upper portion of the cased hole large enough to permit the use of a tapered string of drill pipe. On completion of the drilling operations, the 7-in. liner could be connected to the surface.

The last section of casing, from 40,000 to 50,000 ft., was designed as a liner also, but using 5-in.-o.d. pipe.

TABLE 3—PROPOSED CASING PROGRAM FOR A 50,000-FT. WELL
(After Guernsey)

Interval (ft.)	Footage (ft.)	Size. o.d. (in.)	Wt. per ft. (lb.)	Grade	Joint
1,500-11,500	10,000	13⅜	72	N-80	Buttress
11,500-13,400	1,900	13⅜	78	N-80	Buttress
13,400-15,000	1,600	13⅜	78.47 P.E.	N-80	Buttress
0-7,000	7,000	9⅝	53.5	EHS-150	Buttress
7,000-12,500	5,500	9⅝	47	P-110	Buttress
12,500-17,800	5,300	9⅝	53.5	P-110	Buttress
17,800-23,900	6,100	9⅝	53.5	EHS-150	Buttress
23,900-30,000	6,100	9⅝	58.4	EHS-170	Buttress
0-6,600	6,600	7	32	EHS-150	Extreme line
6,600-19,500	12,900	7	29	P-110	Extreme line
19,500-25,000	5,500	7	32	P-110	Extreme line
25,000-30,000	5,000	7	35	P-110	Extreme line
			Liner		
30,000-40,000	10,000	7	35	EHS-150	Extreme line
40,000-50,000	10,000	5	20.10 P.E.	UHS-170	Extreme line

TABLE 4—PROPOSED TUBING PROGRAM FOR A 50,000 FT. WELL

Interval (ft.)	Footage (ft.)	Size. o.d. (in.)	Wt. per ft. (lb.)	Grade	Joint
0-6,100	6,100	2⅞	1.9	EHS-150	Grayloc
0-6,100	6,100	2⅞	7.9	EHS-150	Grayloc

TABLE 5—PROPOSED DRILL STRING FOR DRILLING A 50,000-FT. WELL

Interval (ft.)	Footage (ft.)	Size o.d. (in.)	Wt.per ft. (lb.)	Grade
0-13,000	13,000	5½	24.7	135,000 psi. yield
13,000-19,600	6,600	4½	20	*BRV
19,600-50,000	30,400	3½	15.5	*BRV

*BRV-Blue ribbon vanadium—105,000 psi. min. yield.

Editor's note: The difference between the designs proposed by Abernathy and Guernsey is obvious. This does not indicate a point of disagreement, however, as any given number of qualified engineers could submit as many different designs for casing strings, and they would all be satisfactory.

Tubing. The design factors used in calculating the casing strings were used in the tubing-string design. These are based on the same assumptions and conditions mentioned previously. Table 4 contains the results of these calculations, which were based on the properties of 2⅞-in.-o.d. tubing.

Drill pipe. One of the main objectives in designing the drill-pipe string is to maintain high torsional strength and good hydraulic characteristics, particularly when drilling the open-hole section from 40,000 to 50,000 ft.

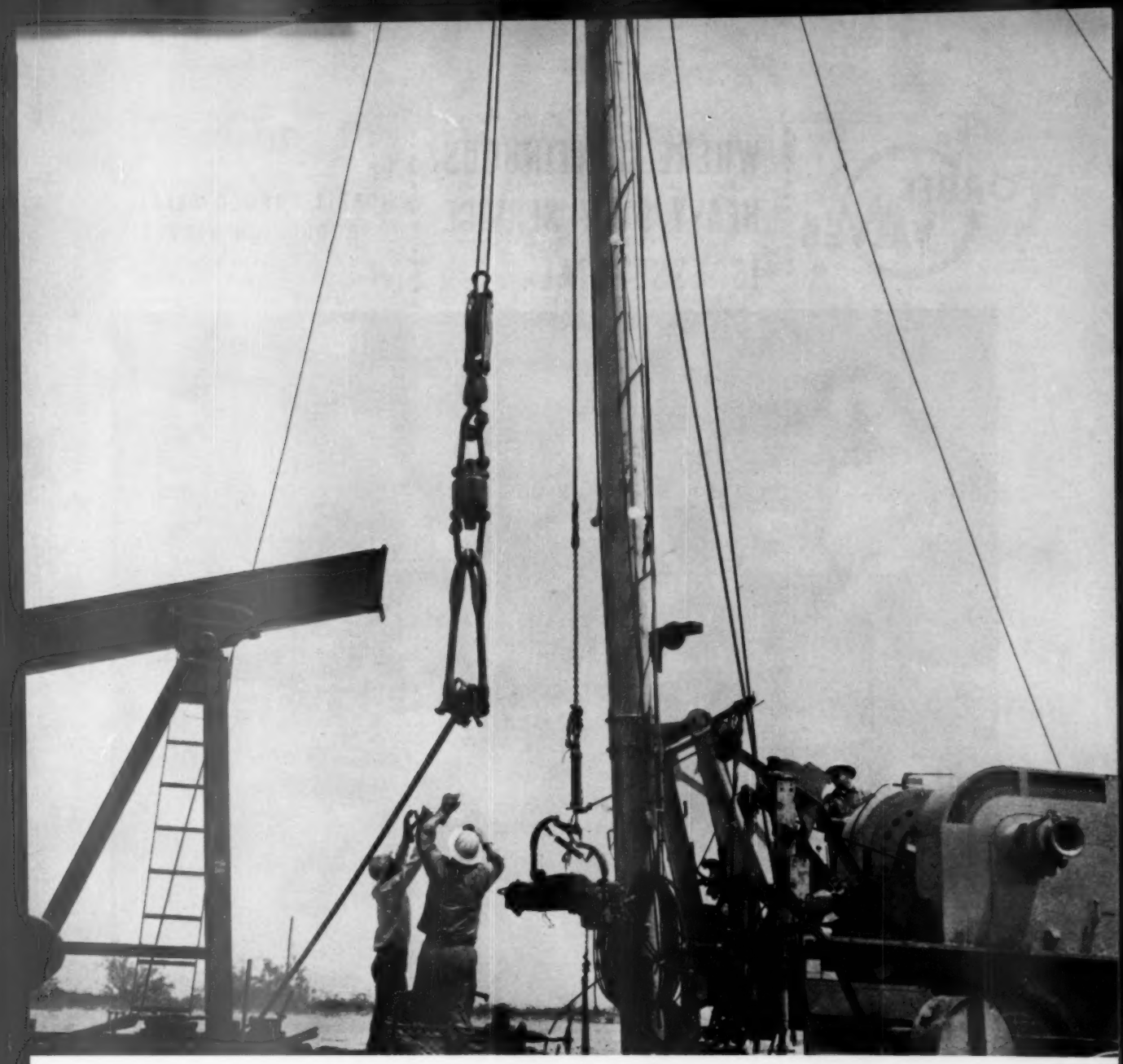
Several designs were tried before one was selected, and the selection was made on the basis of best hydraulics. It was estimated that the pressure loss in 50,000 ft. of tapered drill pipe would be 3,300 psi. with 15.4-lb. per gal. mud at 150 g.p.m.

The basic design was made using tension as a parameter. In case extremely high mud pressures were to be used, the string would have to be reviewed for burst in the upper section.

The same assumptions and design factors were used in the design of the drill pipe as were used in the casing and tubing designs. The results are shown in Table 5.

Further study indicated. The job of designing tubular goods for a hypothetical 50,000-ft. well has shown that further study is needed in some areas of engineering knowledge.

- The effect of temperature in the 700°-1,000° F. range on mechanical properties of pipe should be studied.
- Methods of pipe handling should be reviewed with emphasis being placed on the elimination of operations which may cause notching of the pipe. The use of slips on the rig floor is one of the first things that should be eliminated.
- Torque requirements necessary to rotate and drill at 50,000 ft. should be determined.
- Compressive forces on the surface casing caused by the support given the intermediate and production strings should be evaluated.
- Improvement of the machinability of high-strength pipe while maintaining extreme tensile properties is needed.



Work-over Job in the McElroy Field . . . with Bethlehem Wire Rope. This photograph, taken early in 1959, shows a work-over job on a dual completion well in the McElroy Field, near Crane, Texas, which was handled by Well Servicing Company of Crane. The well ranged in depth from 9,000 to 12,000 ft. The Bethlehem wire ropes used in this assignment were 12,000 ft of 9/16-in. 6 x 7 Formset mild plow, right lay, with solid plastic core, and 500 ft of 7/8-in. 18 x 7 Formset Purple Strand, Non-Rotating. In addition, ½-in. 6 x 31 Formset Purple Strand, right lay, with IWRC, was used for the guy lines. Always dependable, top-quality Bethlehem rope is an old favorite on servicing units.

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Producing the 50,000-footer

PRODUCING A WELL from 50,000 ft. is going to be a real challenge to the metallurgist, the engineer, and to the researcher. In order for these people to proceed with plans for their operations, bottom-hole conditions must be determined. Since we have no 50,000-ft. holes to test, we must project our present knowledge to that depth, and make some estimates of the expected conditions.

How hot? The thermal gradients measured in deep-well bores, if extended, will yield a temperature between 700° and 1,000° F. at 50,000 ft. The generally accepted gradient of 1¾° F. per 100 ft. of depth will give

Bottom-hole temperatures will probably exceed 800° F.

a temperature of 830° F. at 50,000 ft.

In drilling its 1-EE University, Phillips Petroleum Co. engineers measured a bottom-hole temperature of 355° F. at 25,340 ft. Between 18,000 ft. and total depth, the gradient was 1.5° F. per 100 ft. of depth. In the 1 Montgomery well, 16 miles away, a temperature of 380° F. was observed at a depth of 23,000 ft. From 18,000 to 23,000 ft. in this well, the gradient was 2° F. per 100 ft. of depth. As the well was deepened to 23,400 ft. the temperature increased to 472° F. as hot sulfur water was encountered.

The evidence is rather limited, but it would appear that the temperature gradient increases with depth. Further data may be obtained in the future from other deep wells, and from the Mohole project.

Pressure. If a productive zone is in communication with other fluid-bearing formations, or in contact with a large aquifer, the bottom-hole fluid pressure would probably be in the range of 24,000 to 28,000 psi. If the reservoir fluids are trapped in a closed faulted segment, the formation pressure could reach the 50,000-psi. mark due to the overburden pressure.

A shut-in, dry gas well wilth a bottom-hole pressure of 50,000 psi. would have a wellhead pressure of about 42,000 psi. If the bottom-hole pressure were 25,000 psi., the wellhead pressure would be 18,500 psi. These figures are based on a bottom-hole temperature of 800° F. and a surface temperature of 70° F.

Temperature Problems

It is felt that high temperature would present more problems than high pressure. Materials in common use today in equipment for specific jobs and services are not able to withstand the high temperatures expected. Let's look at some specific examples.

Perforating guns. Explosives used in most jet perforators today will not stand temperatures above 350° F. for long periods of time. Some research work has been done, and explosives with high-temperature tolerance are being developed, but it will be a long time before we have a gun and an explosive that will give satisfactory results at more than 800° F.

Logging equipment. The development of high-temperature electrical insulation is probably the biggest problem in the development of satisfactory logging equipment. Not only will the mechanical properties change with

The properties of materials used in the manufacture of logging equipment will change with elevated temperature, and some redesign is indicated.

elevated temperature, but many materials exhibit changes in electrical properties as well. Research is now going on in a specially designed high-temperature laboratory of one of the leading logging companies, and they may be ready to log our first 50,000-ft. hole. Governmental research in the missile and atomic-energy field has yielded a mass of high temperature-pressure data, but this has not been made available to industry.

Landing casing and tubing. One of our current unsolved problems deals with the temperature effect on tubing as the produced fluids change the average temperature in the pipe. Buckling occurs, and special packers are required to maintain fluid seals under these conditions. In a 50,000-ft. well, these problems would be multiplied many times. A temperature change of 200° F. in a 50,000-ft. string of tubing would tend to increase the length by more than 65 ft. For certain steels, the amount of expansion would be even greater.

Buckling and bending due to this expansion might be reduced in one of several ways:

- Provide a tension adjusting type wellhead.
- Provide a telescoping tubing joint above, below, or within the packer.
- Cement the tubing and casing from top to bottom.

Wellhead design and metallurgy need improvement.

Wellheads. Extremely high temperatures and pressures would require improvement in both the basic design and metallurgy of today's wellhead equipment. Metals developed for the tubular goods in the well can probably be adapted to this type equipment.

Packers. New materials for downhole packers would have to be developed. Present-day rubber and lead compounds are completely inadequate

Some artificial cooling will be needed to get efficient surface separation of oil and gas.

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Field separation. Efficient gas liquid separation is possible with choking under present conditions of wellhead temperature and pressure. But, the extremes to be expected will introduce a new problem. Some form of mechanical refrigeration may be needed to obtain a maximum yield of liquid products from the well effluent.

Corrosion

Corrosion, being a chemical reaction, is always accelerated by high temperature. Even trace amounts of H_2S and CO_2 would have enough partial pressure to create undesirable conditions. It is felt that presently used inhibitors and protective coatings would be useless at 800° F. Perhaps the best answer lies in the development of corrosion-resistant materials for all subsurface equipment.

Lift Problems

Fluid produced from 50,000 ft. would probably be gas or gas-condensate, and there'd be no lift problem.

But, we don't know what the nature of the fluid might be, so we must explore some of the possibilities.

Gas lift. This is the only known lift mechanism that could be used to produce crude from a 50,000-ft. well. And it could only deplete the reservoir to a pressure around 10,000 psi.

Gas would probably be injected into the tubing up the hole at some point where the liquids were beginning to drop out of the vapor phase. The injected gas would lighten the column of liquid, and would also upset the equilibrium between liquid and vapor, and tend to vaporize the liquids, which would further lighten the column of fluid.

Due to the long gas column in the annulus, the surface pressure required to inject gas-lift gas would be of the order of 6,000 psi., and this is within the range of presently available equipment.

Sucker-rod pumping. A sucker-rod string to handle a 1-in. plunger at a depth of 50,000 ft. would have to be 6½ in. in diameter at the top joint, if the string were perfectly tapered, to stay below the 40,000-psi. permissible rod stress. The polished-rod load would exceed 1,500,000 lb.

Other systems. A hydraulic-lift system would require a power-oil injection pressure in excess of 13,000 psi. at the surface, not counting fluid friction. Bottom-hole electric-motor-driven turbine pumps would be impractical because of the electrical insulation problems mentioned earlier.

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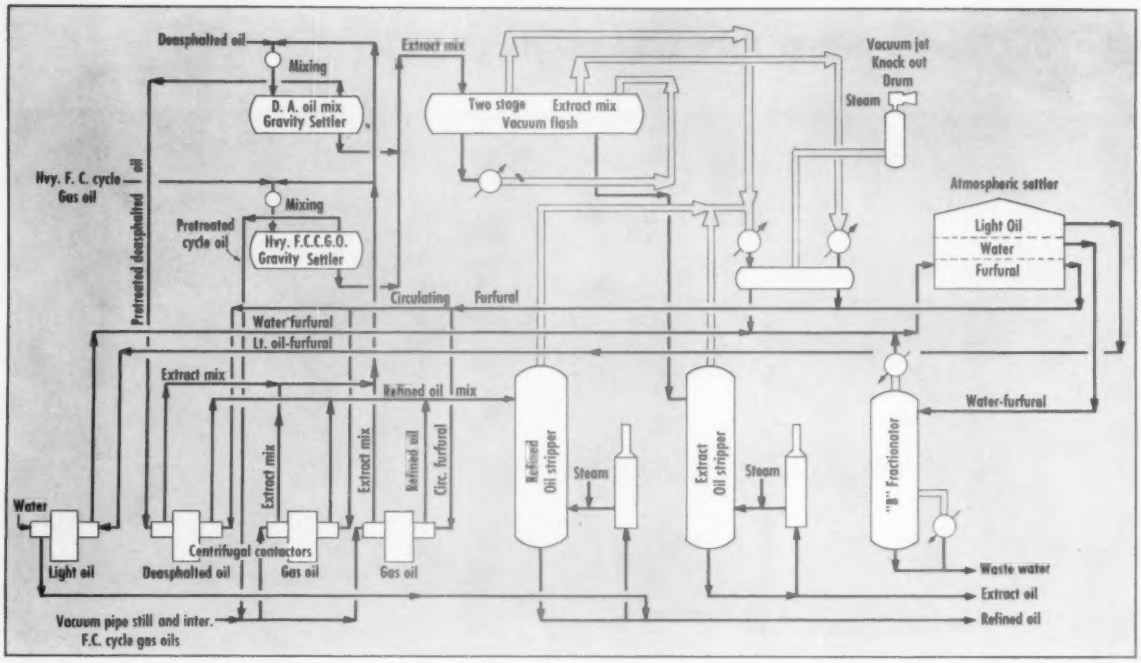


FLOW DIAGRAM of furfural refining at Texaco's Los Angeles refinery. Fig. 1.

How furfural refining increases gasoline

FURFURAL EXTRACTION, long used to produce high-quality lubricating oil stocks and distillate fuels, is now upgrading feed stocks for fluid catalytic cracking units at two Texaco Inc. refineries. The units have been in operation for several years and are helping to increase gasoline production at each refinery.

Studies based on these operations show that furfural refining will:

1. **Minimize fuel-oil production** by making severe visbreaking, coking, or deep deasphalting practical.

2. **Reject undesirable components** of heavy coker gas oils and low-gravity deasphalted oils leaving excellent paraffinic catalytic cracking feed stocks. This, in turn, will increase both charge capacity and conversion in the catalytic cracker.

3. **Give superior yield distribution** from refined oils, allowing greater percentage of the gas oil charged to the cracking unit to result in gasoline.

Los Angeles Refinery

Fig. 1 shows a simplified flow diagram of the Los Angeles furfural-refining unit. It includes extraction, product-stripping, and solvent-recovery equipment.

Three extractors are operated in parallel for furfural extraction of vacuum pipe-still, intermediate-cycle, and pretreated heavy cycle gas oils plus pretreated deasphalted oil.

Extraction temperatures, along with other operating conditions, are varied depending upon the oil and the degree of improvement sought.

The extract phases flow from gravity settlers to a vacuum flash vessel where the majority of furfural is flashed overhead. The remaining extract phase is pumped to the extract stripping tower for complete furfural removal. Raffinate phases from the contractors are charged via heat exchange to the refined-oil stripper. Product streams from these strippers average less than 0.01 wt. % furfural.

Condensed overheads from the two strippers and the first-stage vacuum flash enter the vacuum settler. Since some low-boiling-range oil is contained in the furfural-refining-unit charge stream, small amounts of "light" oil will distill over from the stripper towers along with the water and furfural. Most of the light oil and water are separated from the furfural which is returned to the circulating-solvent storage tank.

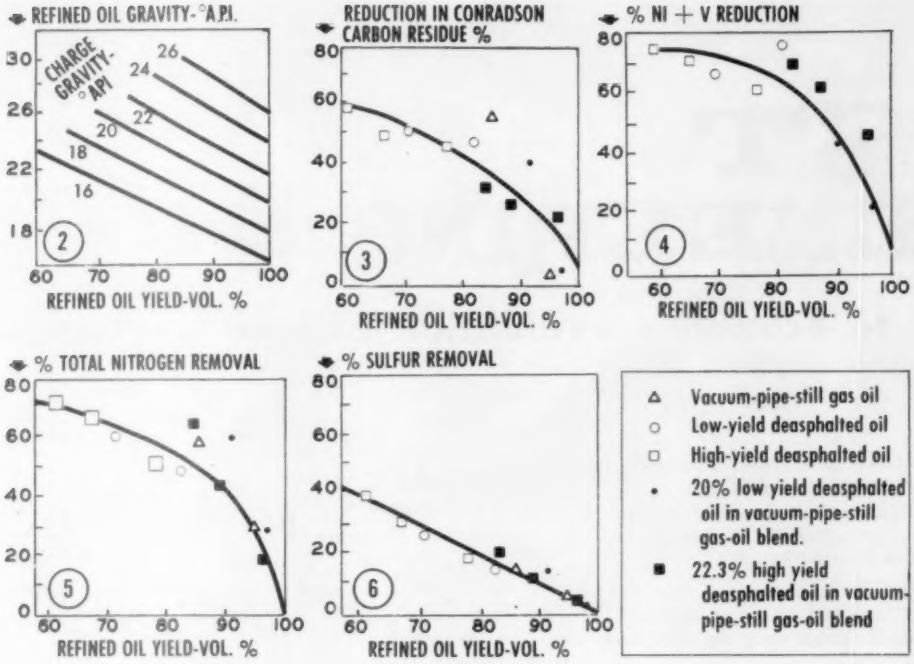
Bottoms from "B" fractionator are furfural-free (less than 0.005%) waste water. With nominal 500 ASTM i.b.p. charge stock very little light oil is produced. However, the furfural is recovered from the light oil produced from any charge stock.

Water or small quantities of light oil as diluents in the circulation solvent can be tolerated and in some cases water may even prove advantageous in a properly designed plant.

Yields and qualities. Figs. 2 through 6 show data for furfural refining California vacuum pipe-still gas oils, deasphalted oils, and blends of these components. Fig. 2 reflects an approximate relationship between refined-oil yield, charge gravity, and refined-oil gravity which may be extended with reasonable accuracy to virgin and deasphalted oils other than presented here. Figs. 3 through 6 show that furfural refining of virgin stocks results in good carbon-residue reduction, excellent metals and nitrogen removal, and moderate sulfur removal.

Improvement in commercial fluid catalytic cracking unit yields gained

Paper presented at the fifty-second annual meeting of AIChE, San Francisco.



YIELD and quality data for furfural-refining California vacuum pipe-still gas oils, deasphalted oils, and blends of these components. Figs. 2-6.

production in two Texaco cat crackers

BY R. R. DICKINSON AND C. B. LONGSWORTH
Texaco Inc.
Wilmington, Calif.

from furfural refining is presented in Table 1. Two periods, of 1 week each, with similar crude sources, at comparable FCC unit charge rates and operating conditions, are presented. Under normal conditions the furfural unit was refining a mixture of vacuum pipe-still and cycle gas oils. When the unit shut down, it was necessary to increase virgin gas oil to the fluid unit by about 1,800 bbl. per stream day to maintain a constant FCC unit charge. In spite of this butane-retention naphtha dropped about 1,100 bbl. per stream day.

Fluid-cracked heavy cycle gas oil may be separately extracted on the plant contactor. Table 2 shows that a 54% yield of high-quality raffinate can be obtained from this operation. This raffinate, when compared to a standard blend of California virgin gas oils proved to be a superior cat cracker feed stock. At constant space velocity the raffinate underwent higher conversion to produce 11% more butane-retention naphtha and 33% less coke than the virgin charge blend.

TABLE 1—COMMERCIAL FLUID CATALYTIC CRACKING CALIFORNIA VIRGIN AND FURFURAL REFINED OILS

Fluid cracking unit feed preparation	Furfural refining unit offstream Seven day period	Furfural refining unit onstream Seven day period
Furfural refining unit charge	Offstream	.....
Intermediate catalytic cycle gas oil, B/D	Offstream	3,060
Heavy catalytic cycle gas oil, B/D	Offstream	1,200
Vacuum pipe-still gas oil, B/D	Offstream	17,940
Total, B/D	Offstream	22,200
Gravity, °API	Offstream	23.5
Refined oil, B/D	Offstream	19,700
Gravity, °API	Offstream	25.7
Extract, B/D	Offstream	2,500
Gravity, °API	Offstream	6.9
Crude still and vacuum pipe-still gas oils to fluid unit	29,390	9,670
Total virgin feed	29,390	27,610
Fluid cracking unit process conditions—		
Unit charge rate, B/D	29,390	29,370
Charge gravity, °API	26.3	27.5
Feed preheat, °F.	730	726
Reactor temperature, °F.	963	956
Type catalyst	Filtrol 100	Filtrol 100
Catalyst-addition rate, tons/day	5	5
Coke burned, lb./hr.	22,000	22,400
Carbon on catalyst, wt. %	0.41	0.48
Fluid catalytic unit products—		
Gas, M.c.f.d.	13,690	14,110
Propylene, B/D	2,160	2,070
Butylene, B/D	2,230	2,690
Light naphtha, B/D	4,130	5,090
Heavy naphtha, B/D	5,680	5,350
Cycle gas oil, B/D	14,320	*9,700
Butane retention naphtha, B/D	12,040	13,130
Percentage yields, vol. %—		
Reactor charge conversion	51.3	52.5
Butane retention naphtha basis virgin gas oil	41.0	47.6

*Corrected for cycle gas oil recycle to furfural unit.

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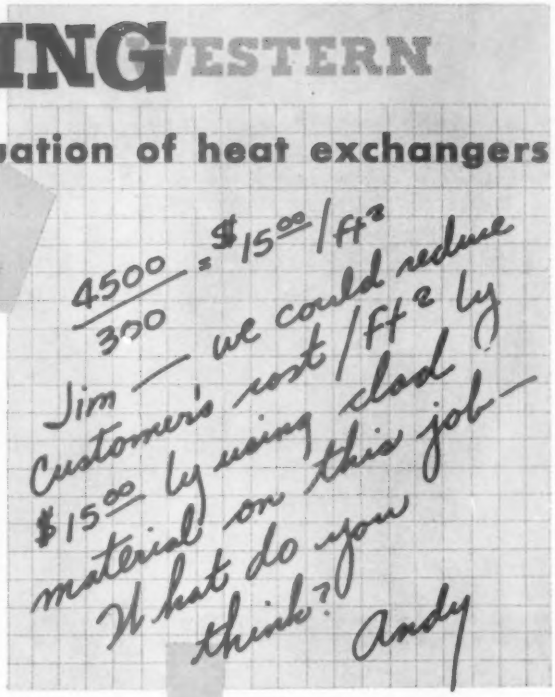
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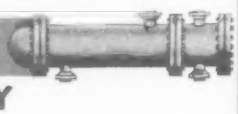

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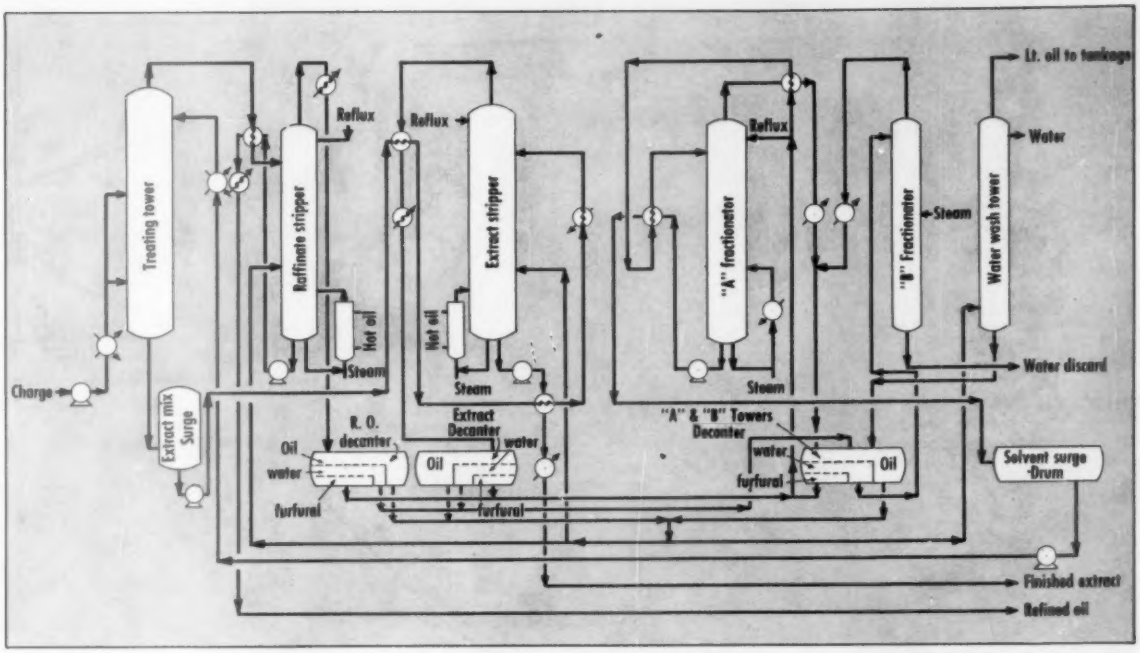


PROCESS FLOW for Texaco's Eagle Point refinery in Westville, N. J. Fig. 7.

Eagle Point Refinery

Process flow for the Eagle Point refinery at Westville, N. J., is shown in Fig. 7. Originally designed to charge 8,000 bbl. per stream day light catalytic gas oil at a relatively high solvent dosage, commercial practice showed that much lower solvent dosages are practical. Using these lower dosages unit capacity has been increased to 14,000 bbl. per stream day, allowing refining of the total cycle gas-oil production from the FCC unit.

High-quality distillate fuels[2 3 4 5] and FCC unit feed stocks[6] from this unit have been previously reported.

Extraction is effected by countercurrent flow through a packed column equipped with heat-exchange equipment for control of the extraction temperature. Solvent is removed from product mix streams by stripping in atmospheric towers with steam and heat from a hot-oil system. No vacuum-flash systems are used and the unit is operated at about atmospheric pressure. An extractor recovers furfural from the current production of light oil. An "A" fractionator for dehydration and removal of miscible oil allows refining with "dry" furfural when desired. In normal operation it is unnecessary to use the "A" fractionator.

TABLE 2—COMPARISON OF FURFURAL REFINED FC HEAVY CYCLE GAS OIL WITH VIRGIN CHARGE CALIFORNIA CRUDE OPERATIONS

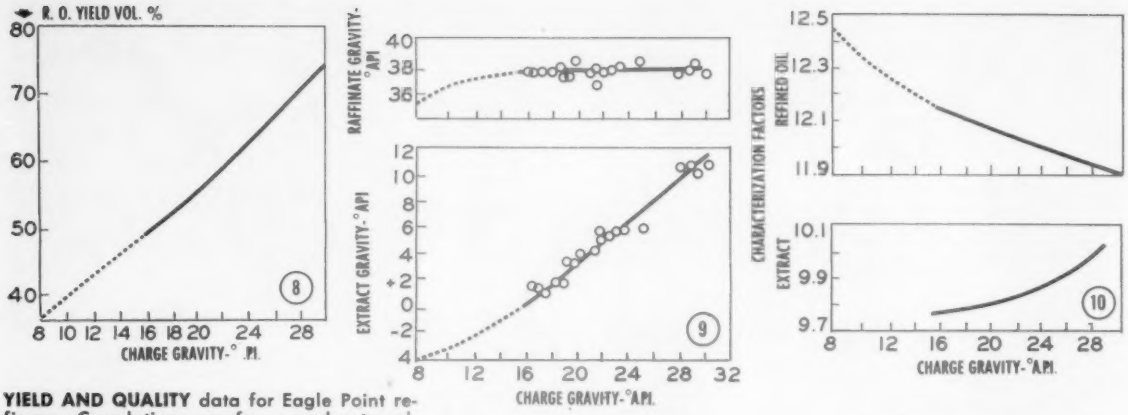
Oil stock	Heavy catalytic cycle gas oil	Refined heavy catalytic cycle gas oil	Standard California virgin gas oil blend
Refined oil yield, vol. %	.....	54.0	...
Oil qualities			
Gravity, °API	18.4	33.7	28.3
Refractive index	1.5380	1.4680	...
Viscosity, S. U. S. at 100° F.	51	49	77
Carbon residue, Wt. %	1.17	0.02	0.25
Sulfur, wt. %	0.96	0.46	0.99
Characterization factor	10.9	12.0	11.8
ASTM distillation:			
I. b. p.	480	352	430
10%	573	546	534
20%	598	576	578
50%	648	633	676
Metals, Ni + V, p.p.m.	2.1	1.1	...
Catalytic Feed-Stock Evaluation			
Space velocity, Lb./oil/hr./lb. cat.	*	1.15	1.15
Gas, s.c.f./bbl.	*	302	305
Propylene, vol. %	*	12.3	9.8
Butylene, vol. %	*	15.8	11.7
Debutanized naphtha, vol. %	*	35.7	34.9
Cycle gas oil, vol. %	*	41.5	45.0
Coke, wt. %	*	4.90	7.31
Conversion, vol. %	*	58.5	55.0
Butane retention naphtha, vol. %	*	51.5	46.6

*Not available.

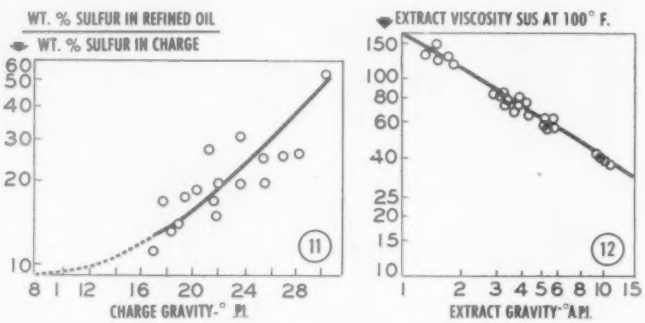
Mixed cycle gas oil. The Eagle Point unit normally charges mixtures of light and heavy cycle oils rather than charging only one type at a time. Figs. 8 through 12 present plant yield and quality data plus correlations for a moderate solvent dosage using furfural with a small amount of light oil. Dashed portions of these curves are extrapolations of the plant data to experimental data on refining of heavy cycle gas oil with a somewhat higher percentage of "wet" furfural.

Refined-oil yield from the cycle gas-oil mixture is a function of charge gravity and increases with API gravity of charge from 36% for heavy cycle to 75% for light cycle gas oil. The average refined-oil gravity remains a constant 37.6° API over the range of commercial operation, but decreases slightly in the extrapolated range. Extract API gravity increases sharply with increasing charge gravity. Sulfur removal increases from 50% for light cycle gas oil to 91% for heavy cycle gas oil.

Furfural extracts have good cutter-stock values throughout the range of plant data. Raffinates having the



YIELD AND QUALITY data for Eagle Point refinery. Correlations are for a moderate solvent dosage on a charge mixture of heavy and light cycle oil. Dashed lines are extrapolations of the plant data to experimental data using a higher percentage of "wet" furfural. Figs. 8-12.



highest characterization factors and extracts having the lowest characterization factors are obtained from the heaviest cycle oils. Based on catalytic cracking unit correlations, the raffinate from the heavier cycle stocks has the highest value as cracking feed stock.

Typical data for furfural refining Eagle Point cycle gas oils resulting from a mixture of cycle gas oils from Arabian and Venezuelan crude operations are shown in Table 3.

Heavy cycle gas oil. A 7.9° API Eagle Point FCC heavy cycle gas oil has been furfural refined without difficulty on a laboratory pilot unit using both dry and wet furfural. A maximum refined oil yield of 38 vol. % was obtained refining the heavy cycle gas oil with wet furfural. Substitution of dry furfural for wet has little effect other than slightly improved solvent power.

The aromatic component of the oil is soluble in furfural while the paraffinic component is almost insoluble. Raffinate quality is unaffected by varying the dosage over a wide range. When the solvent dosage is twice that at which a raffinate phase separates, there is almost complete separation of the two components. Below the dosage at which complete separation occurs, lower raffinate yields result from dissolved raffinate in the extract stream.

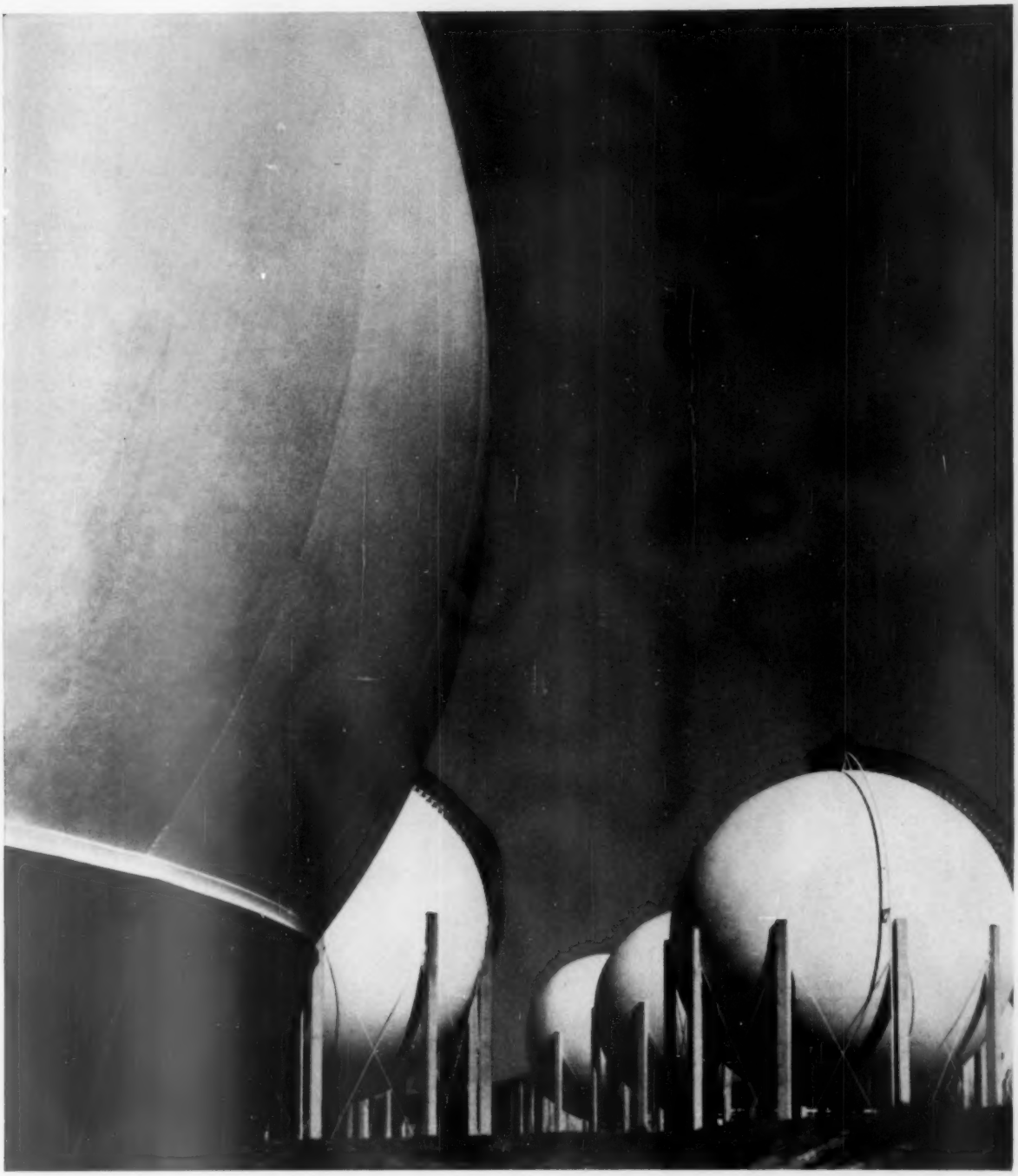
Cracking refined oil. Both laboratory and plant investigations[2 8] have shown that refined oil produced from mixed cycle gas oil charged to the Eagle Point furfural-refining unit is comparable in cracking yields to that of virgin oil of similar boiling range. In a plant comparison the Eagle Point FCC unit was operated alternately on refined cycle gas oil and virgin gas oil. Both oils were derived from similar mixed Arabian-Venezuelan crude operations. Constant fluid cracking operating conditions, including space velocity, were maintained with both feeds. Operating conditions and yields are presented in Table 4. The refined cycle oil underwent slightly less conversion but produced nearly the same butane-retention gasoline yield and less gas. The product gasoline from refined cycle gas oil was of superior quality, having lower sulfur content, higher octane rating, and lower average boiling point.

Furfural losses. Commercial experience shows that solvent loss approximates 0.015% of feed. These losses are of the same order of magnitude generally found in furfural lube-oil refining.

Additional cracking capacity. C. F. Tears[9], in his article on furfural treating of cycle gas oils, shows the economic advantage of using furfural refining to expand the virgin gas-oil capacity of a catalytic cracking unit. In his study the virgin charge capacity of a unit is increased about 55% by replacing direct recycling of cycle gas oils by recycling of heavy cycle gas oils through a furfural-refining unit. Because of furfural refining, this charge increase is accomplished with-

TABLE 3—FURFURAL REFINING OF EAGLE POINT CATALYTIC CYCLE GAS OIL

	Light cycle gas oil			Mixed cycle gas oil			Heavy cycle gas oil		
Refined oil yield, vol. %				75.8			65.3			37.0		
		Refined			Refined			Refined		
Gravity, °API	31.4	39.8	10.0	24.5	38.1	3.7	7.9	34.5	−4.0
I.b.p.	484	478	502	480	481	495	570	580	.....
10%	505	500	517	506	503	519	672	668	.....
50%	528	525	538	557	544	608	736	752	.....
90%	567	565	589	749	724	.....	.....	.....	.....
E. P.	595	592	630	.....	.....	.....	.....	.....	.....
Vis. S.U.S. at 100° F.	36.1	36.4	37.6	42.9	40.3	62.4	278	91.0	.....
Pour point, °F.	+5	+10	.....	+10	+50	.....	+75	+95	.....
Aniline point, °F.	138	168	.....	141	181	.....	133.7	221	.....
Sulfur, wt. %	1.10	0.35	3.10	1.70	0.44	3.63	3.43	0.36	.....
Cetane number	42.0	60.0	.....	.....	.....	.....	.....	.....	.....
Carbon residue, wt. %	.....	.....	.....	.....	.....	.....	4.12	0.18	.....
Characterization factor	11.5	12.1	10.0	11.2	12.2	9.8	10.5	12.5	.....



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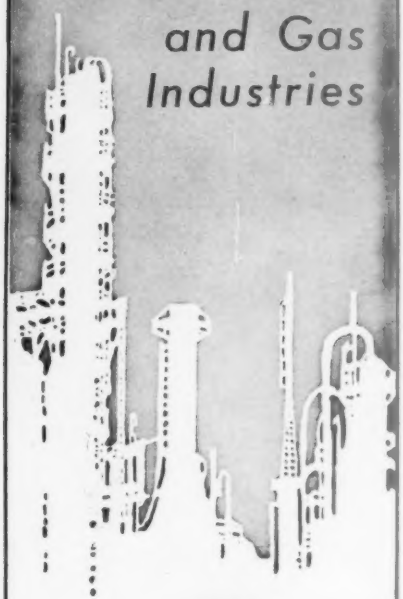

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out lowering the volume per cent yield of butane-retention naphtha from the virgin gas oils. Investment costs for the addition of the cycle gas-oil refining unit are shown to be roughly one-third that otherwise required to build 55% additional catalytic cracking capacity.

Many catalytic cracking units are limited in charge rate and conversion by either coke-burning capacity or gas-handling facilities. To such units the application of furfural refining will allow an increase in both charge capacity and conversion. Because of the superior yield distribution from refined oils a greater percentage of the gas oil converted results in gasoline. Thus the refiner can expect higher gasoline yields from the installation of a furfural-refining unit.

Investment and operating costs. Individual estimates of operating costs are generally meaningless, since such costs depend on the cost of utilities at the particular refinery involved, and these costs vary widely from plant to plant. Investments also vary. Texaco Development Corp., as the licensor of furfural refining, can furnish estimates for any specific installation.

Table 5 shows utility requirements for the Los Angeles refinery furfural unit when operating at design capacity.

TABLE 5—UTILITY REQUIREMENTS PER DAY FOR LOS ANGELES FURFURAL REFINING UNIT AT 24,000 BBL. PER DAY

Fuel gas, M.M.B.t.u.	1,730
Steam supplied at 200 psig, M-lb.	810
Steam supplied at 15 psig, M-lb.	130
Cooling water circulated, M-gal.	6,120
Electric power for motors, lights cooling tower, etc., Kw.-hr.	14,400

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1. Kemp, Hamilton, and Gross, Ind. Eng. Chem., Vol. 40, p. 220, 1948.
2. Gross, Skelton, and Best, The Oil and Gas Journal, p. 211, March 23, 1950.
3. Anon., World Petroleum, p. 57, Annual Refining Issue, 1950.
4. Texaco Development Corp., Pet. Refiner, Vol. 29, No. 9, p. 196, 1950.
5. Gee, Gross, and Skelton, Proc. of Third World Pet. Congress, Section III, p. 132, 1951.
7. Reman and van de Vasse, Pet. Refiner, Vol. 34, No. 9, p. 129, 1955.
8. Carter, R. T., The Oil and Gas Journal, p. 157, March 22, 1954.
9. Tears, C. F., The Oil and Gas Journal, p. 120, June 15, 1953.

TABLE 4—PROCESSING EAGLE POINT VIRGIN AND REFINED OILS FROM MIXED ARABIAN-VENEZULEAN OPERATIONS

Charge	Virgin oil			Refined cycle oil
Fluid Catalytic Cracking Process Conditions				
Fresh feed, B/D	31,224			30,960
Gas-oil recycle, B/D	5,220			5,220
Slurry recycle, B/D	1,860			1,860
Reactor temperature, °F.	923			921
Total air to regenerator M-lb./hr.	278			292
Carbon on regen. cat., wt. %	0.92			0.84
Charge-Oil Quality				
Gravity, °API	30.4			34.1
ASTM distillation, °F.				
I. b. p.	448			482
10%	506			526
50%	648			591
90%	750			760
Sulfur, wt. %	1.10			0.47
Carbon residue, wt. %	0.070			0.023
Nitrogen, wt. %	0.082			0.018
Viscosity, S. U. S. at 100° F.	60.9			45.7
Product Yields	Vol. %	Wt. %	Vol. %	Wt. %
Ethane and lighter	....	3.88	....	3.47
Propylenes	....	5.08	....	4.05
Butylenes	12.05	8.07	17.30	11.83
Pentane to 430° F. v.t. gasoline	38.97	33.63	32.88	29.14
Total cycle oils 430° F. v.t. I.b.p.	42.12	43.03	44.71	46.11
Coke	....	5.58	....	5.97
Total	....	99.26	....	100.57
Corrected 430° F. v.t. conversion, vol. %	57.88	....	55.29	....
Butane to 430° F. v.t. gasoline	51.02	....	50.18	....
Debutanized Gasoline Product, °F.				
Gravity, °API	59.0			61.9
ASTM distillation, °F.				
I. b. p.	99			106
10%	128			128
50%	214			191
90%	350			334
e. p.	401			398
Sulfur, wt. %	0.135			0.037
Bromine No.	79.7			71.2
ASTM research octane—clear	92.9			93.8
plus 3 cc. TEL	98.1			98.9

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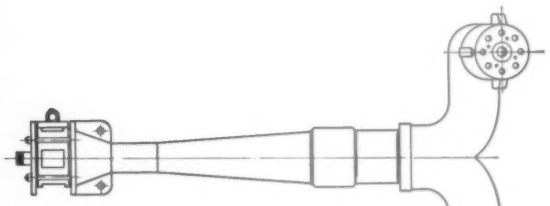
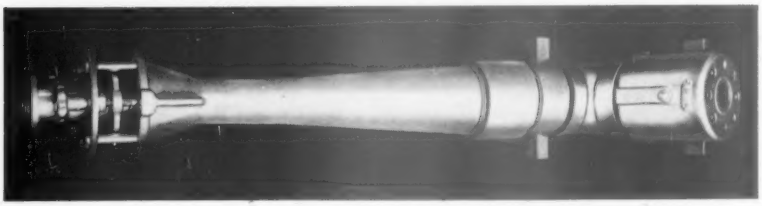


National Airoil 4-inch AIROCOOL venturi inspirating gas burner fitted with a HYDROCOOL nozzle for vertical firing a center wall up draft furnace in a petroleum reforming process.



National Airoil 4-inch AIROCOOL venturi inspirating burner having finger control register for primary air. Also equipped with twin 3-inch HYDROCOOL nozzles for firing against a radiating wall in center wall up draft heaters.

Why Conventional Nozzles are Unsatisfactory for Firing Hydrogen Gas

Conventional flame retention nozzles for venturi inspirating gas burners (Fig. 1) are designed primarily for use with natural gas or those gases of similar composition, heating values and molecular weights.

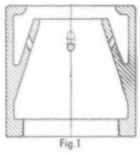


Fig. 1

In firing hydrogen, however, considerable difficulty is encountered, causing mixture "flash-back" to produce an initial explosion and/or continuous burning back within the venturi tube.

Further difficulty is encountered when plant personnel endeavor to correct the condition by disproportionately reducing the primary air to the venturi. The effect of this excessive adjustment is to lengthen the gas flames and risk secondary combustion around the tubes of the convection section in petroleum heaters. These longer and less concentrated furnace flames tend to reduce the heat absorbed by the wall radiant tubes. They also cause inefficient fuel performance by requiring a higher excess air that increases both the stack gas temperature and the fuel consumption.

In some center wall up draft petroleum heaters, the conventional nozzles are burned so badly that gas flames frequently take place in the combustion air ducts under the furnace floor. Photos A and B show the remains of two conventional nozzles that deteriorated after only a few months' duty. With the average center wall up draft heater, it is an expensive undertaking to remove the burners, renew the nozzles and replace the burners. The cost in time and labor greatly exceed the purchase price of the nozzles themselves.

A B

▶ ▶ ▶ New Equipment Section

This week's SHOWCASE features . . .

Automatic control

. . . of flow offered with a new high-pressure remote-control needle valve that has a conventional needle type of stem coupled directly to a pneumatically operated diaphragm mounted on the valve body. The result is an overall height of only 5 in.

Designed for high-pressure service, the valve provides a ratio of line pressure to control in excess of 200:1. This gives it an operating pressure of 10,000 psi. with less than 50-psi. control pressure.

The Model 4888 valve uses conventional methods of control—an electrically operated solenoid valve for straight open and close and an electrically operated solenoid valve with a low-pressure regulator for metering and pressure-relief applications. A choice of body and stem materials are available. Delivery time: immediate. List price: from about $32 for a ⅛-in. to $33 for a ⅜-in. size. Source: **Dragon Engineering Co., Inc., 13457 Excelsior Drive, Norwalk, Calif.**

●

Portable grinder

. . . in 8-in. size now available, a pneumatic type, Series 905, can be obtained with straight, lever, or grip type of handles. Features include (1) lightweight one-piece aluminum housing construction, (2) one-piece hardened and ground spindle, (3) four prelubricated and sealed spindle bearings, and (4) steel inserts in all housing threaded holes and bearing bores. It has a hardened, ground, and honed cylinder.

Delivery time is 1 week. Approximate price, f.o.b. factory, ranges from $75 for small die grinders up to $310 for the 8-in. portable grinder. Source: **Thomas C. Wilson, Inc., 21-11 Forty-fourth Avenue, Long Island City.**

Two-way personal radio

. . . recently brought out is only about twice the size of a king-size pack of cigarettes, including the batteries, in the belt-back model. Two of the radios make a convenient limited-range system for person-to-person communications. The completely transistorized transmitter-receiver unit weighs less than a pound, including batteries.

The maker has five standard models. One has the radio unit and batteries, noise-canceling earphones, and built-in antenna as integral parts of a special plastic safety helmet, with an attached noise-canceling hand microphone. Another model provides a noise-canceling headset with a built-on antenna and noise-canceling microphone, and the unit and batteries in a compact belt-pack.

The units have a printed circuit with crystal-controlled transmitter and super-heterodyne receiver, providing 750 milliwatts of usable audio power. The units are available for use in 27 or 42-mg. operation. The 27-mg. units require no license. All are designed to meet all applicable FCC requirements. Available for immediate delivery, the units range in price from $195 to $325, not including batteries, f.o.b. factory. Source: **Seiscor Div., Seismograph Service Corp., Box 1590, Tulsa.**

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Pumps, piping

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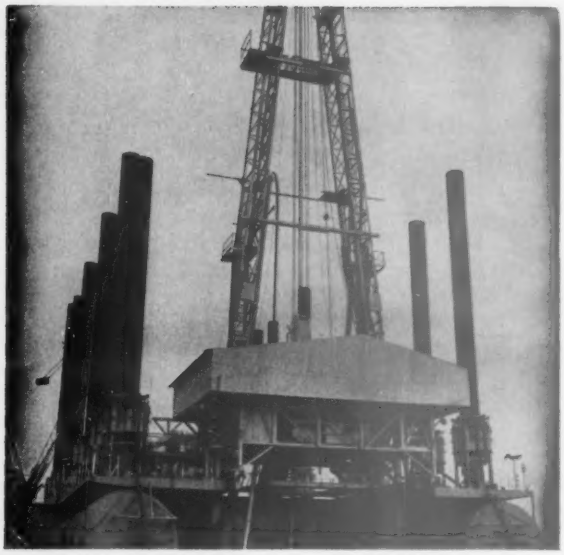

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In operating the device, the operator holds open the grip jaws by either pushing or pulling a hand lever to descend. To ascend, the unit is automatic. Available for three sizes of rope, 5/16, 3/8, and ½-in., the unit lists for $50. Delivery time: immediate. Source: **Griphoist, Inc., 744 Harrison Street, San Francisco 7.**

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. . . can speed jobs inaccessible to radio-equipped vehicles as it can be carried by workers to the job site for two-way communications with other personnel. The radio is portable (8-lb.) FM-type measuring less than 12 in. long. Called the Portacom, it comes with a handset, FM receiver, one or two-channel FM transmitter, demountable whip antenna, battery pack, and carrying strap.

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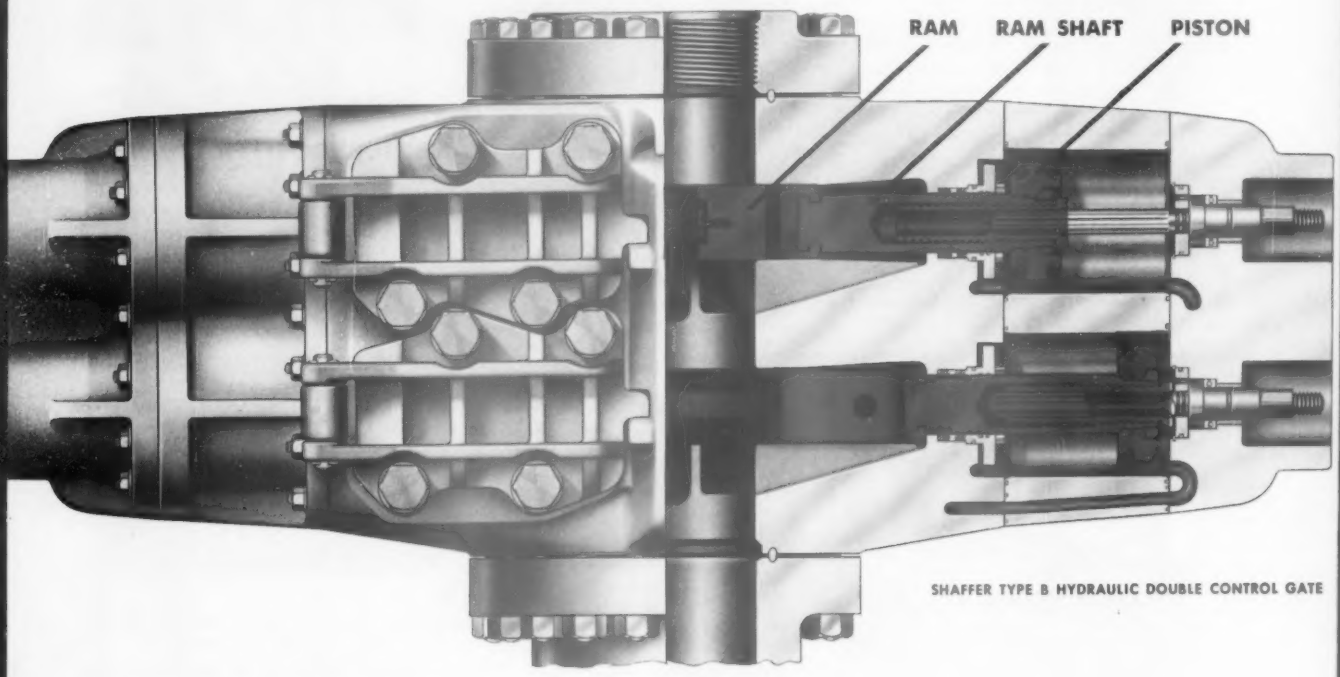

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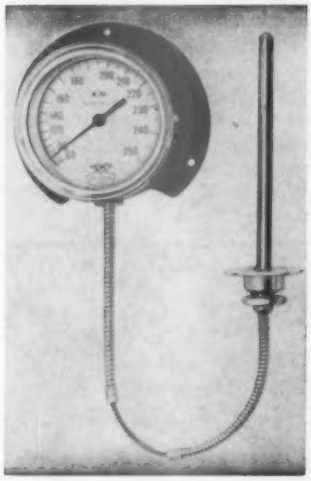

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- Big 35 sq. in. vertical wiring gutters
- Front access continuous horizontal wiring gutter
- Easy access to main lugs

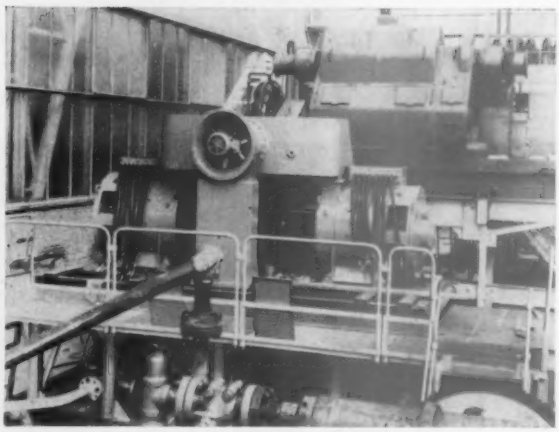
QUALITY FEATURES

- Attractive, ruggedly constructed cubicles
- Main bus at center for less current density in vertical bus
- Rigid 25,000 AIC bus bracing
- Reliable components throughout

NELSON Electric MANUFACTURING CO.
TULSA, OKLAHOMA

SHOWCASE . . .

New Equipment



Diesel-electric drilling rig

. . . developed by a Dutch firm operates on direct current of constant amperage. Intended for drilling depths of 10,000 to 15,000 ft., the equipment is designed so all generators or electric motors are switched off automatically by a two-way switch. The circuit is invariably kept closed.

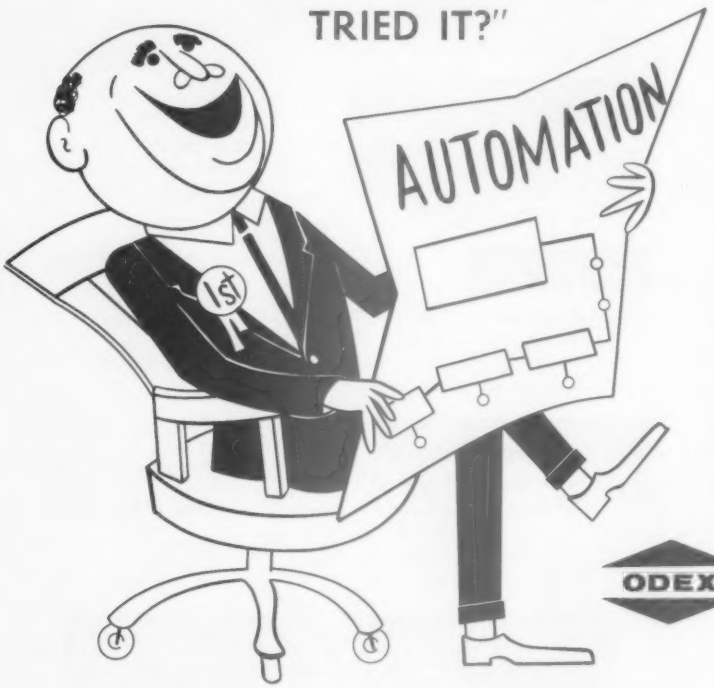
The electric motors control the power output, and the generators are automatically adjusted to the required power output, which is equally distributed among the generators in operation. Enclosed and ventilated, the motors may be provided with safety air lines or inlets. The diesel power required for the equipment ranges from 850 to 1,000 hp. at 1,000 to 1,200 r.p.m. Source: **N. V. Electrotechnische Industrie v/h Willem Smit & Co., Slikkerveer near Rotterdam, Holland.**

Control raises loads

. . . accurately and provides fast load leveling with a high degree of component and personnel safety. The Hydra-Set auxiliary crane and hoist-control instrument comes in 50 and 100-ton capacities and is installed as a link between the crane hook and the load.

Loads up to 100 tons can be raised or lowered a distance of 12 in. with an accuracy within 0.001 in., the maker claims. Approximate price f.o.b. factory, ranges from $1,500 for a 1-ton capacity to $14,000 for a 100-ton capacity. Delivery time depends upon model and ranges from immediate to 3 months. Source: **Mefco Sales & Services, Inc., 131 North Fifth Avenue, Arcadia, Calif.**

"HAS ANYONE ELSE TRIED IT?"



YOU BET THEY HAVE! Hundreds of companies have discovered that one SURE way to cut the costs of lease operations is to call in Odex. Automation is the one positive way to save money today.

Only Odex gives you turnkey service on an integrated system . . . with all components designed to work together. Engineering, specs, and installation are coordinated to lick your specific problems . . . To SAVE YOU MONEY.

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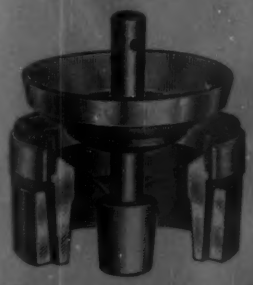
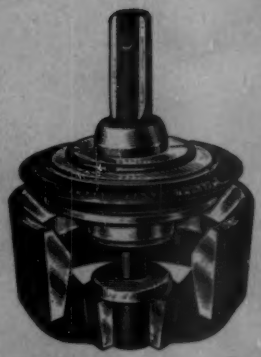
GET THE MOST

Mission SUPER-SERVICE®



Mission MUD MONARCH®



Mission SILVER TOP®

ONE OF THESE MISSION VALVES AND SEATS WILL GIVE YOU THE MOST FOR YOUR MONEY

Because Mission Valves and Seats are designed to give you the most for your particular service. For *extremely high pressures*, the Mud Monarch® with an effective seal ring even when body and seats are severely worn. Compound 308® and Compound 711 inserts are available. For *medium pump pressures*, the Mission Super Service, with four cross arms for extra strength. And for *low and medium pressures*, the Silver Top with replaceable, wear-taking bushing which greatly reduces valve seat replacement. Compound 308 inserts are interchangeable with Super Service valves. Longer life is built in to all Mission valves and seats to give the most with all popular makes of reciprocating pumps. At supply stores everywhere.

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MISSION MANUFACTURING CO., *P. O. Box 4209, Houston, Texas cable address* "MISSCO" • *export office: 30 Rockefeller Plaza, New York*

In The United Kingdom: MISSION MANUFACTURING CO., LTD., *17 Hanover Square, London W. 1 England* • *cable address* "MISSOMAN"

The world's largest crude oil pipe still . . . which has a capacity of 140,000 barrels a day . . . utilizes a 173-foot high primary fractionator tower and 145-foot high vacuum fractionator tower, both built by Chicago Bridge & Iron Company. The new processing unit recently went on-stream at a major midwestern refinery to replace nine smaller, obsolete stills. The towers, both completely radiographed and stress relieved, were furnished through Arthur G. McKee Company.

CB&I *coordinated services* will prove invaluable in projects of magnitude that you may be planning. By blending their individual talents . . . research, engineering, fabrication and erection specialists produce structures which meet the most exacting specifications.

If you demand the best . . . you can't be satisfied with less than CB&I *Craftsmanship in Steel*, skillfully developed over the past seven decades. For details, write our nearest office.

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OFFICES AND SUBSIDIARIES IN PRINCIPAL CITIES THROUGHOUT THE WORLD

New Literature

Design, process

. . . engineer's guide to industrial temperature measurement and control has just been made available free. Filled with charts, drawings, and diagrams, the publication discusses: (1) Ways of responding to temperature; (2) ways of putting temperature response to work; (3) the Partlow element for mercury-bulb instrumentation; (4) nine basic Partlow types of controls; and (5) a score sheet for the mercury-bulb system.

The 24-page guide also provides basic concepts of electrical, pneumatic, and mechanical controls, heat sources and their influence on control systems, circuits and piping arrangements, and first principles of mercury-bulb installation. Six case histories are spotlighted to illustrate instrumentation and what it can do. Source: **Partlow Corp., 532 Campion Road, New Hartford, N. Y.**

Crayons

. . . which indicate temperature, along with their temperature ratings, are described in a newly revised six-page pamphlet. It lists the 80 temperature ratings of Tempilstiks and of Tempilaq, covering the range from 113° to 2,500° F. in systematically spaced intervals and now available as stock items.

Tempil pellets can be obtained in 90 temperature ratings up to 2,700° F. A Fahrenheit and Centigrade equivalents table is included. Source: **Tempil Corp., 132 West Twenty-second Street, New York 11, N. Y.**

New metering-pump

. . . Bulletin P-21 describes operating principles of the Servo-Gauge pump and its controller, which has a pump-plunger - positioning accuracy within 0.002 in. repeatedly. A four-page literature piece offers five typical applications which are explained in terms of suggestions for similar uses.

Design data listed includes maximum capacity, operating characteristics, stroking rate, materials of construction, and actuating-power requirements. Source: **Associated Control Equipment, Inc., P. O. Box 136, Corapolis, Pa.**

Bottom-hole

. . . pressure-measuring devices are featured in a new 24-page brochure, obtainable gratis upon request. Detailed

MASTER MECHANICS CORNER:

Karl Wernle, Master Mechanic in charge of 250 machines for McDougal-Hartmann Co., Peoria, Illinois, working on Illinois Interstate Highway Rt. 74 at Peoria, Ill.

"Most bolts and nuts don't seem to hold our equipment together when the going's rough. We've found Cat bolts and nuts do."

Caterpillar Tractor Co., General Offices, Peoria, Ill., U. S. A.
Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

FILTRATION PROBLEMS?
PRODUCTION INTERRUPTED?
IF YOU FILTER
- LUBE OIL
- FUEL OIL
- COMPRESSED AIR OR GAS
- HYDRAULIC FLUIDS

and you are not getting the results you want; why not write us about your problems?

OVER A QUARTER OF A CENTURY OF EXPERIENCE... is yours for the asking, regardless of size or nature of your filtration problem.

WRITE FOR ANY ONE OR ALL THE INFORMATIVE PUBLICATIONS LISTED BELOW.

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YES! Please send me, without obligation, the literature checked below.

- ☐ TANK TRUCK MANUAL
- ☐ COMPRESSED AIR FOLDER
- ☐ HYDRAULIC FLUID MANUAL
- ☐ GENERAL CATALOG

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Company_____
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PARAFFIN PROBLEMS?

PARAFFIN SOLVENT

Dowell Paraffin Solvent is designed to free your wells of production-robbing paraffin. It will dissolve both pure and impure paraffin containing asphalt, sulphur, gum and salt. Effective for cleaning formation faces, tubing, rods, lead lines, tanks, screens, liners and perforations. **Non-chlorinated.** Easy to use. Easy to buy, too. Available at oil field supply stores and at Dowell stations.

Products for the oil industry

DOWELL

DIVISION OF THE DOW CHEMICAL COMPANY

DIAL DOWELL

are transmitters, receivers, an automatic frequency counter and printer, a regulating and control device, a range-setting device, and accessory equipment.

Packed with cross-sectional instrument drawings, pictures, graphs, charts, and specifications, the literature also gives services, prices, and terms. Source: **Otis Engineering Corp., P. O. Box 35206, Dallas.**

Industrial hammers

. . . with soft faces are outlined in a new literature piece now available for distribution. The four-page bulletin illustrates and describes a full range of plastic hammers, with or without replaceable screw-on plastic tips. Also described is a new "no-bounce" hammer, babbitt hammers, and tamper drifts. Source: **Metocraft Alloy & Plastic Co., 1039 Memorial Avenue, West Springfield, Mass.**

Products for Tooling

. . . bulletin now obtainable tells how many manufacturers have saved time and reduced costs in their tooling programs by using certain materials.

Using case histories, eight-page Bulletin 2 gives details of successful applications of Devcon in making jigs, fixtures, metal-forming dies, duplicating masters, and other tools. Source: **Devcon Corp., Danvers, Mass.**

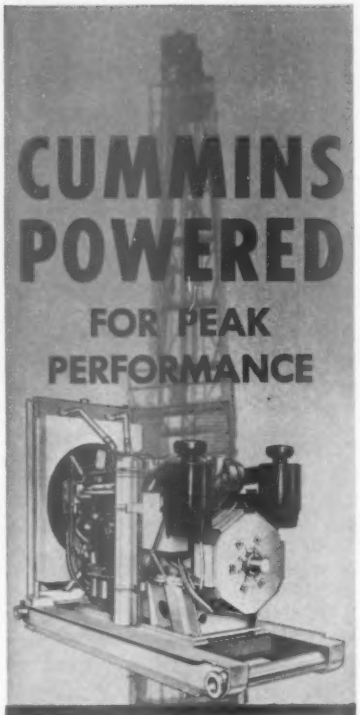
Butterfly valves

. . . and operators are discussed in a new 36-page publication. It contains information on Darling-Pelton rubber-seated valves, designed in accordance with American Water Works Association specifications, and for hydrostatic operating pressures up to 125 psi. and velocities up to 16 ft. per second. Also included in Catalog 5904 are data on construction and design, dimensions, ordering directions, general hydraulic data, materials, and operation methods. Source: **Darling Valve & Ffg. Co., Williamsport, Pa.**

316-page catalog

. . . of general equipment describes over 3,400 different items ranging from a pocket-sized soil penetrometer to completely equipped drilling sets and nuclear moisture and density-testing equipment. The 1960 catalog—devoted mainly to engineering testing equipment—also features about 1,500 illustrations. Referenced to ASTM and AASHO specifications, the publication contains recommended equipment lists for specific types of testing projects. Source: **Soiltest, Inc., 4711 West North Avenue, Chicago 39.**

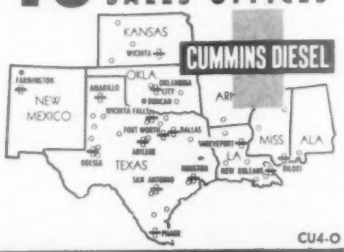
CUMMINS POWERED FOR PEAK PERFORMANCE



CUMMINS VT-12 ELECTRIC DRILLING UNIT

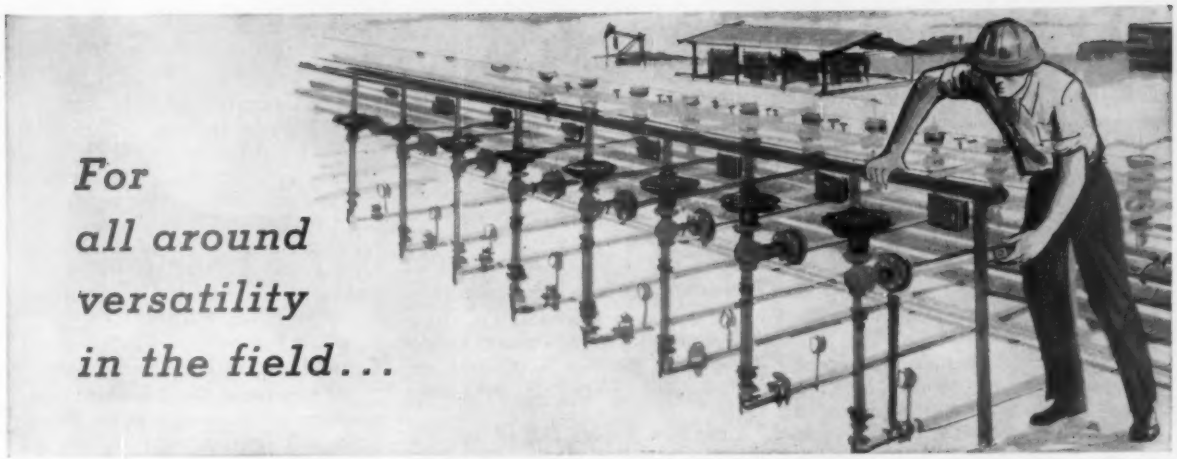
More and more drilling contractors are specifying Cummins VT generator power for their electric drilling equipment. These contractors have found that these Cummins 12-cylinder TURBODIESEL engine powered generator sets give them important benefits of proven dependability, faster drilling, minimum move and rigup time, reduced initial investment and Cummins service. Get full details now from your nearby Cummins representative about the powerful, compact VT-12 TURBODIESEL for every oil field use.

16 FACTORY-TYPE SERVICE SHOPS SALES OFFICES

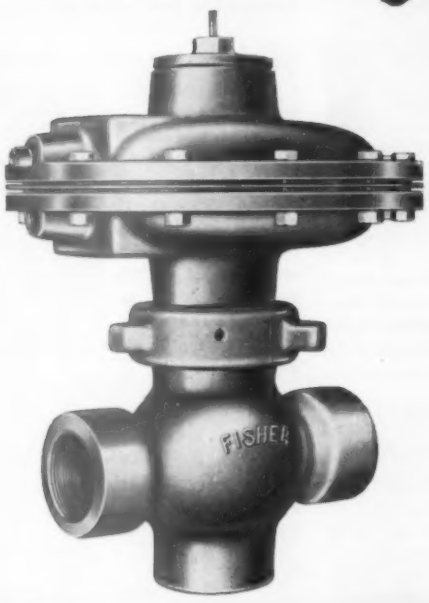


CU4-O

CUMMINS Sales & Service, Inc.
P. O. Box 10338
FORT WORTH 14, TEXAS



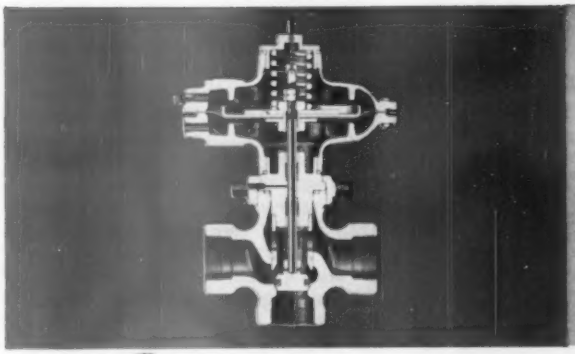
FISHER "Oilmans" VALVE



Type 1664

3 way-2 position diaphragm control valve

- **Wide application in well testing, manifold systems and diverting services.**
- **Low in price—tops in performance.**
- **All internals can be removed without taking body out of the line.**
- **Spring action reversible in the field.**
- **Quickly converts to two way action.**
- **Body rating to 400 psi WOG.**
- **Also available as pressure balance control valve.**



Design Features

Cast Iron valve body is available in 2″ size with screwed or grooved end connections. 2″ screwed end body has $C_v = 24$ and $C_g = 850$. Compact, sturdy construction with No. 3 Type 125 top work as standard. Available in spring opposed or pressure balanced construction.

IF IT FLOWS THROUGH PIPE ANYWHERE IN THE WORLD...CHANCES ARE IT'S CONTROLLED BY...

FISHER GOVERNOR COMPANY

Marshalltown, Iowa / Woodstock, Ontario / Rochester, England

BUTTERFLY VALVE DIVISION: CONTINENTAL EQUIP. CO., CORAOPOLIS, PA.

FISHER® Controls

SINCE 1880

▶▶▶ Equipment Men Notes

J. B. (Ben) West will manage

J. B. West

... Western Hemisphere oil-field sales for Cummins Diesel International Ltd., announces Reece Hatchitt, director of international operations for Cummins Engine Co., Inc., Columbus, Ind. West will represent the company in Latin America and Mexico, specializing in sales of diesel power. He will reside in Sao Paulo, Brazil. West formerly was with U. S. Steel International Ltd., and Oil Well Supply Division of U. S. Steel Corp. He spent the past 3 years in Rio de Janeiro.

Union Tank Car Co. announces

... that the business of its Graver Tank & Mfg. Co. plant at Sand Springs, Okla., has been reorganized into a separate company which will operate as a division of Union Tank Car.

The new company, which makes process equipment for use on oil and gas wells, especially in the Southwest and Rocky Mountain states, will be known as Graver Oil & Gas Equipment Co., Division of Union Tank Car Co.

Charles B. Briggs, former vice president of Marley Co., Kansas City, is president of the new division. E. G. Vail remains as plant manager, and C. P. MacDonald as sales manager.

Annual sales meeting is held

... in Lufkin, Tex., by Lufkin Foundry & Machine Co.'s Oil Field Division. More than 50 men from the United States, Canada, and South America attended the 3-day conference. Additional home office personnel participated making a total of more than 100 in attendance.

L. A. (Pete) Little, vice president of the company, and Cooper Richards, assistant sales manager, presided at most of the sessions. Reports from various districts were heard and visits were made to the company's production, engineering, and administrative facilities.

Two sales managers appointed

... by Jefferson Chemical Co., Inc., in Houston (R. Harry Borden) and in Philadelphia (Stanley W. Cairns), reports Ralph E. Werley, Jr., sales manager.

Until now Borden had served as a Jefferson salesman in the southern region. Prior to joining the company in 1957, he held posts of salesman and assistant secretary of Dixie Chemical Co.

R. H. Borden

S. W. Cairns

Cairns has been with the company since 1952 as a salesman in New York. Following service in the U. S. Navy, he rejoined the company in 1958 as salesman in the eastern region.

Iverson Supply Co. opens office

... in Oklahoma City headed by H. B. Williams, who has been promoted to a sales-representative position. Williams was formerly manager of Iverson's store in Oklahoma City.

Meanwhile, George W. Hicks, Jr. takes over as the new store manager at Oklahoma City. In the oil-field-supply business for over 15 years, Hicks was previously with Continental Supply Co. and Lucey Products Co.

ANNUAL SALES MEETING of Rector Well Equipment Co., Inc., held recently at the Fort Worth general offices, also marked the firm's 30th anniversary. Attending were 47 employes representing management, engineering, production and sales departments, and representatives from the United States and Canada. J. L. Pinkard, sales manager, presided. L. L. Rector, president, addressed the meeting, outlining the company's progress and plans for the future.

Empire Geophysical, Inc. sells

... its Logging Division to Pan Geo Atlas Corp. (PGAC). Empire has been engaged in the field of Acoustic logging and velocity surveying since 1953 when its Logging Division was originally organized as Empire Velocity Service Co. In 1957 this company and Empire Geophysical, Inc., the parent organization, merged.

Crane buys business and assets

... of Swartwout Co., Cleveland manufacturer of electronic controls. Swartwout will operate as a division of Crane Co. and will continue under the guidance of Kenyon and Charles Swartwout. The acquisition is seen as an important factor in advancing Crane's entrance into the fields of automation and automatic valving.

Baash-Ross Division appoints

... Harry Siegley as district sales manager in Dallas, according to R. A. Forsman, sales and service director. Siegley will handle both domestic and export sales in the area. He has served the division at Wichita Falls as district sales manager since 1952.

Harry Siegley

At the same time, Brooks Doughtie was named district sales representative handling both domestic and export sales in the Baash-Ross Tulsa office. A division employe since 1956, Doughtie was transferred from the company's Houston offices.

Baash-Ross is a division of Joy Mfg. Co.

Delta Tank Mfg. Co., Inc. sets up

... a 24-city network of oil-field-equipment sales offices and supply houses in 9 petroleum and gas-producing states. The network will provide direct manufacturer-to-customer sales and service for a full line of equipment, including Delta's Dryex unit which recovers quantities of raw gasoline, butane, and propane previously lost in natural-gas streams.

Office locations include Tulsa; Denver; Rock Springs and Casper, Wyo.; Williston, S. D.; Kimball, Neb.; Hobbs and Farmington, N. M.; Houston, Snyder, San Antonio, Dallas, Midland-Odessa, Corpus Christi, Pampa, and Wichita Falls; New Orleans, Houma, Morgan City, Westwego, Shreveport, and Lafayette; and Laurel and McComb, Miss.

Daniel Orifice Fittings Co. holds annual sales meeting in Houston

Sales representatives from six regional offices met for the 2-day session on sales policies and goals. The meeting was conducted in a new research laboratory the company has erected on its plant site.

Highlights were discussions of new products the company plans to market this year, plus expansion plans which are already under way. The sales representatives came from Daniel offices in Los Angeles, Odessa, Dallas, Corpus Christi, Harvey, Tulsa, as well as from Houston.

Rush is district engineer

. . . for McMurry Oil Tool Specialties. He will represent the company in a territory extending from Liberty, Tex., to Lake Charles, La., and from the Gulf of Mexico to Lufkin, Tex.

Carl Rush recently resigned his position as petroleum engineer for Pan American Petroleum Corp.

Geophysical Service, Inc. makes

. . . several changes in its Dallas home office organization, reports President R. C. Dunlap, Jr.

John McCormack, with GSI since 1957, has been appointed an assistant vice president. He will continue in his duties as controller but, in addition, will coordinate activities of the personnel, equipment, and industrial-engineering departments.

J. W. Thomas, vice president and former manager of marketing, has announced his intention of retiring later in the year after 30 years with the concern. He will continue to be associated with the petroleum-exploration firm.

R. H. Rainey has been named to succeed Thomas as manager of marketing. After joining GSI in 1947, Rainey served as a field supervisor in the United States, Canada, and Australia. His last field post was as Far East operations manager in Singapore.

Paul J. Hart is appointed

. . . tubular-products salesman for Jones & Laughlin Steel Corp. in the Tulsa sub-office of J&L's St. Louis sales district, reports C. M. Merritt, general sales manager. Hart comes to J&L from National Supply Co., where he served in the sales department from 1952 until 1959.

Vapor Recovery Systems opens

J. L. Caler

. . . a new office in El Cerrito, Calif., under the direction of James L. Caler, district manager. Caler was formerly a technical representative for North American Aviation, Los Angeles division. The new office will offer service and warehouse facilities to Varec customers in northern California and Oregon. J. L. (Joe) Johnson, sales engineer in the southwest, moves up to regional sales manager, West Coast, with headquarters at the Compton, Calif., plant. Johnson has been with the firm for the past 20 years.

J. L. Johnson

R. W. Milligan

Robert W. Milligan has been appointed district manager, Los Angeles. He was formerly in field service of North American Aviation, Los Angeles. Milligan will direct sales and service operations in the southern California territory.

English firm changes name

. . . to Powell-Duffryn Engineering Co., Ltd. The company—formerly named Cambrian Wagon & Engineering Co., Ltd., a subsidiary of Powell-Duffryn, Ltd., will remain as a spe-

AMERICAN®

GASCLOK

POWER

DRIVE

Completely self-contained gas or air-powered instrument driving and timing unit for long, trouble-free operation in remote locations. The GASCLOK delivers more than 20 times the torque of conventional spring-wound mechanisms. Continuous timing accuracy is unaffected by a ± 20% variation in supply pressure.

Inherently explosion proof and self-starting, the GASCLOK is ideal as original or replacement equipment for strip chart and conventional circular chart instruments. The timing mechanism is internally sealed to prevent corrosion, and all power unit parts exposed to gas are aluminum or stainless steel. Large area internal ports prevent clogging. Normal air or gas consumption 5 cfh . . . operating pressure 5 psi . . . rotation 2 rpm.

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METER COMPANY
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Executive Offices: Philadelphia 16, Pa.
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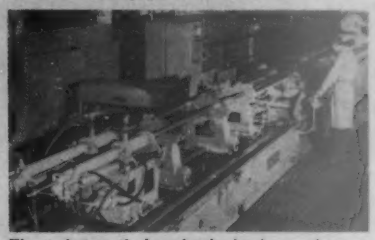
USI Axelson **PUMPING NEWS**

Axelson Increases Pump Life

Hardened Barrel Tube is flame-hardened to a uniform minimum depth of .025". Finish on all tubes and plungers is controlled to provide maximum lubricating qualities, retains oil.



Finest Automatic barrel tube honing equipment in industry has a built-in micrometer which makes a pass through the tube with each stroke of the hone. Automatically stops machine when desired I.D. tolerance is achieved.

Looking to New Slim Hole Completions?

Contact your Axelson man about new slim hole developments. Typical is Axelson's Thru-Hard coupling for slim hole production. It's used in place of a hardened and ground coupling. The Thru-Hard coupling has a built-in toughness without sacrifice of strength. Try it and see.

Write Today for New Literature

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Axelson Division
U. S. Industries, Inc.
6160 So. Boyle Avenue
Los Angeles 58, California

- ☐ New Hard-Faced Axite Plunger
- ☐ Slim-Hole Pump
- ☐ 1960 Composite Catalog

NAME_____

COMPANY_____

ADDRESS_____

Longer Pump Runs Result From Barrel Tube And Plunger Manufacturing Developments

Equipment life and production runs can be increased through better barrel tubes and plungers in proper combination. Axelson field representatives are trained to prevent customers from paying for a premium tube or plunger when it may be unnecessary, because, in many cases, a more economical combination may be available. In addition, Axelson has spent thousands of dollars improving manufacturing techniques to produce the most complete selection of barrel tubes and plungers available. Here are the facts:

Barrel Tubes—Axelson's hardened tube has the heaviest case known for maximum wear resistance. It is combined with a strong, resilient, tough outside diameter. Only the I.D. is case-hardened. Threaded ends are unhardened to retain their inherent toughness.

A uniform case depth and hardness is maintained, eliminating soft spots. Axelson helped steel companies develop non-destructive ferro testing to avoid split tubes. Quality is upheld through concentricity, straightness, finish and closely maintained tolerances.

Unhardened tubes are produced for mildly corrosive wells, etc. Exceptionally hard chrome I.D. tubes are available for salt water type corrosion conditions, particularly where abrasion is a problem.

Plungers—The best runs are accomplished by a proper combination of tube and plunger. A careful choice of both is necessary. Axite, chromium plated, hardened steel, regular steel, niaxite, and composite (eutectic, regular iron, hard cast iron) plungers are produced by Axelson to give production men as wide a selection of equipment as possible.

For example, Axelson's Axite plunger surfaces are highly resistant to abrasion, impervious to salt water, extremely resistant to hydrogen sulphide, and non-galling (lowest coefficient of friction of any type plunger available). Axite particles have a hardness of 9 on the Mohs Scale. They are best for extremely corrosive conditions.

Field Tested—A highly abrasive and corrosive California well in the Bakersfield oil field had consistently chewed up ordinary plungers (such as one shown at right) in a matter of several weeks. Axite plungers were finally installed. The Axite plunger shown at left ran 25% longer than the best previous plunger.

© 1960—U.S. Industries, Inc., Los Angeles, Calif.

cialist firm in all forms of railway rolling stock, but is expanding in equipment manufacture for petroleum and chemical industries. The company also has become sole license manufacturers within the United States for the complete range of mobile materials-handling equipment of Dempster Bros., Inc., of Knoxville.

Williams is sales representative

... in the Tulsa Mid-Continent Division of C. Lee Cook Co., reports William H. Barnes, sales manager. Now locating in Amarillo, Tex., Charles E. Williams formerly was a lubrication engineer with Gulf Oil Corp., Midland, Tex.

Joss is administrative assistant

John Joss

... to Leigh Taylor, vice president in charge of marketing of Southwestern Industrial Electronics Co., a division of Dresser Industries, Inc. Joss formerly was with SIE's advertising and publications department. Before joining the Houston firm in 1957, he was with Schlumberger Well Surveying Corp. in Houston, and prior to that, Imperial Chemical Industries, London, England.

Howard Book retires

... as senior vice president of Reed Roller Bit Co. He will be retained by Reed in a consulting capacity, but also plans to open an office in Houston as a foreign-trade consultant specializing in foreign oil-tool sales, manufacturing, and licensing agreements for American firms. Book, in charge of foreign sales for the past 20 years, served Reed a total of 31 years.

Dressler M. Pruett transferred

... to Cooper-Bessemer Corp.'s Tulsa district office as a sales engineer, announces A. W. Abel, Mid-Continent district manager. Pruett will work in that area under Abel's supervision on the application and sales of C-B compressors and engines.

Since 1957, Pruett has been assigned to the sales department at the company's Mount Vernon, Ohio, headquarters. Prior to his association with Cooper-Bessemer, he was with E. I. du Pont de Nemours & Co., Savannah River plant.

George R. Kritzer is named

... Houston district sales manager of Yuba Consolidated Industries, Inc., in which post he will direct sales for several Yuba manufacturing divisions. He also will coordinate the sales efforts of Yuba agents and manufacturers' representatives in the Houston area.

Before joining the firm, Kritzer was sales engineer for J. F. Pritchard Co. in the Houston area. Prior to that he was with A. O. Smith Corp. in Houston, and with C. F. Braun & Co. in New York and California.

John D. Nicholson is manager

... of Houston Engine & Pump Co., with main office and shops in Houston and branches in Corpus Christi and Harvey, La. Prior to this appointment, Nicholson was vice president of Southern Engine & Pump Co.

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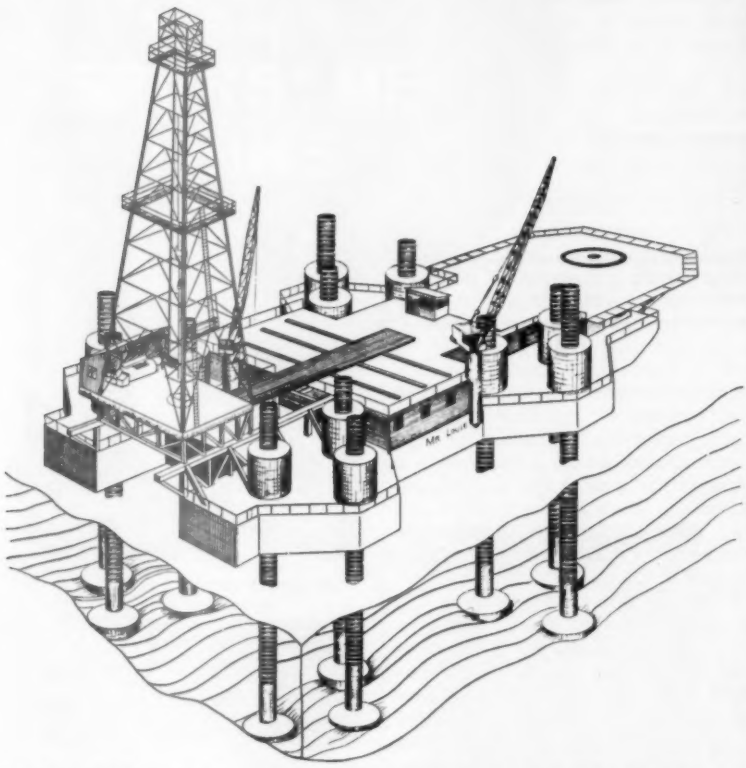

THIS DRILLING PLATFORM—the "Mr. Louie," owned by Universal Drilling Co.—is raised off the ocean floor by a semiautomatic jacking system that is controlled by a console panel operated by one man.

How Mr. Louie keeps a firm footing

A DRILLING PLATFORM may be required to drill on a site that doesn't have the soundest or most level footing on the ocean floor in offshore work. A description of the equipment used by Mr. Louie—the platform of Universal Drilling Co., Inc., New Orleans—to keep it firm of foot and on a level keel is a study of man's ingenuity.

To keep the barge's legs firmly planted on the gulf bottom and lift the platform out of the water, twelve caissons are used. These are controlled by an Oilgear Co. of Milwaukee semiautomatic electrohydraulic servosystem.

The drilling barge can be raised 40 ft. out of water in depths up to 120 ft. It is a single hull, mobile, self-leveling unit. Each caisson is 6 ft. in diameter surrounded by clamp rings for most of its 211-ft. length. Eight of the caissons extend through the barge proper, but to increase the vessel's stability, the other four caissons pass through four sponsons. All the caissons are planted firmly on the gulf bottom when in operation and give Mr. Louie legs to stand on above the waves. The body, or platform of the barge, is a 204-ft.-long by 133-ft.-beam hull weighing 4,000 tons.

Control station. From a central control console, one operator is in complete control of the jacking system. Indicator controls at the console provide him with such information as speed of caisson or platform travel, position of the caissons and platform, operating pressure of each caisson fluid-power system, whether Mr. Louie is level, position of the platform and

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ram caisson jaws, and motors for pumps in on or off positions.

Hydraulic components. Each hydaulic system at the twelve caissons consists of an electronic amplifier, an Oilgear DY-3517 radial rolling position, two-way variable delivery pump with integral electrohydraulic servo control, auxiliary pump, and relief valves; a solenoid pilot-operated three-way valve; solenoid pilot-operated holdup valve, and four double-acting hydraulic cylinders. The cylinders are integrated with the jack frame which is fastened to the platform with a rubber mount to allow for flexing. The rams are connected to a rigid ring frame containing a pair of half-round jaws. A holdup valve is connected to the ram end ports of one of the four cylinders. Each pump with its respective drive motor is mounted on a reservoir base close to the jack frame and caisson it operates. Each caisson system operates independently, but all are synchronized through electrohydraulic circuitry.

The operator at the console is also provided with a control by which he can operate each caisson jacking system individually. All twelve caissons are lowered in unison until resistance of the gulf floor is met. Since the weight of the caissons is greater than their buoyancy forces, it is advantageous to meter the caissons downward at a controlled speed through a regenerative system.

When the caissons have been lowered in unison to a point where resistance of the gulf floor is met, the operator switches the control to provide individual caisson operation. By means of the servocontrol and direct reading position indicators, meters and pressure gages, the operator can continue to lower or drive each caisson downward independently and also apply a predetermined preload force greater than the platform mass. The exact bearing stress established on each caisson is read directly on the pressure gages in the control room.

If a power failure should occur at any time, the holdup valves, one at each caisson jacking system, would stop the flow of oil out of the cylinders and prevent the platform from drifting downward.

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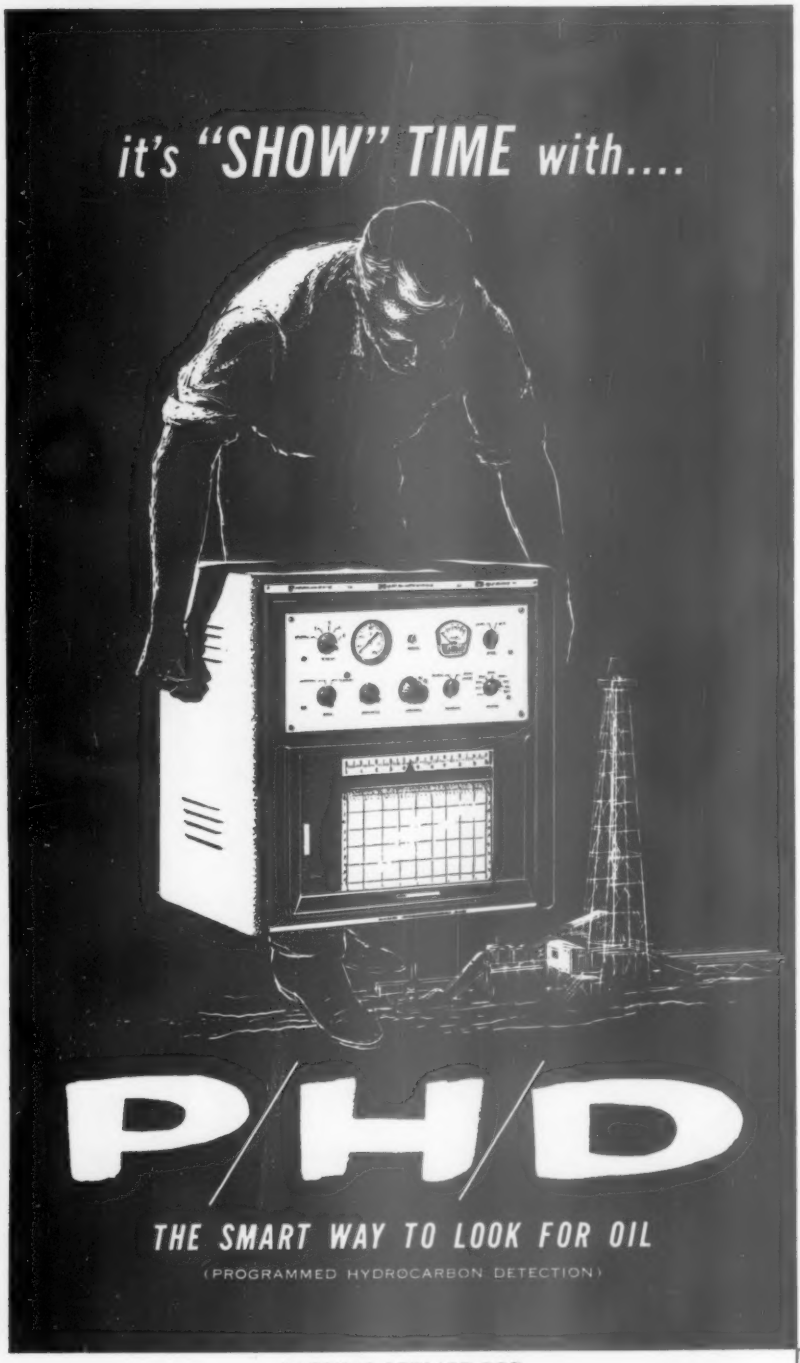

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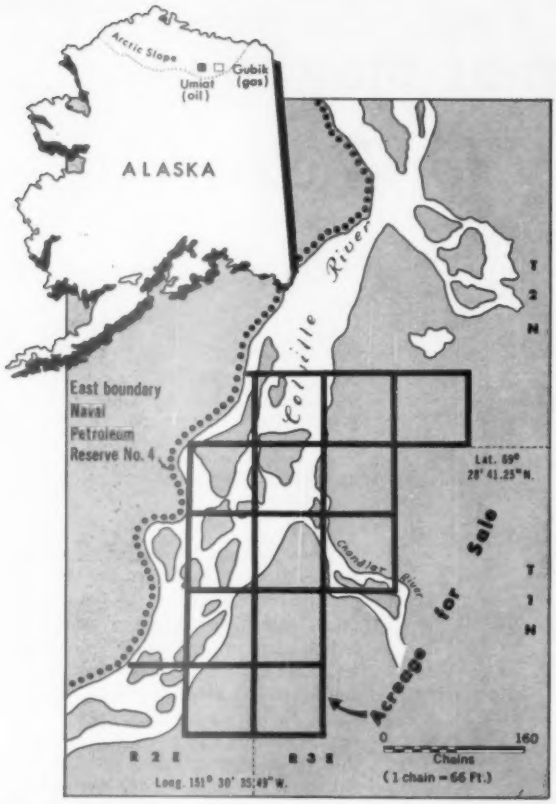


THE U. S. Bureau of Land Management will open bids this week on these blocks of acreage on the Arctic Slope. The leases are believed to overlie some choice portions of Gubik gas field of northern Alaska.

"Buffer zone" sale may provide some real bargains

BY FRANK J. GARDNER

ONE OF THE more interesting sales of the year will take place this week . . . and there may be some real bargains to be had.

Bids will be received on February 24 for 16 parcels of federal lands heretofore called the "buffer zone" adjoining Naval Petroleum Reserve No. 4 on Alaska's Arctic Slope. All the acreage is believed to lie on the huge Gubik gas anticline; the Navy drilled two wells to the southeast of the offered land. One was finished as a gas well and the other blew out and was destroyed by fire after yielding some good shows of both oil and gas.

Lying at the confluence of the Chandler and Colville rivers, 2,720 of the 9,105 acres offered for sale lie "offshore" in the waters of the two river beds. Royalties on any production found will be payable to the United States Government at a rate of 12½-25% for oil, and 12½-16⅔% for gas. The annual rental is stipulated at $1 per acre.

This buffer zone has held the attention of many Alaska operators for a long time. It was set up a few years ago to prevent drainage of any oil or gas that might be discovered in the NPR itself. Millions of acres to the east have earlier been released for leasing by private interests, and in a 1958 sale, bids there ranged from $1.07 to $103 per acre (OGJ, Sept. 8, 1958, p. 68, and Sept. 15, 1958, p. 112).

Just what kind of plum is the Gubik anticline? According to U. S. Navy reports, it should be a juicy one. Naval exploration was pretty thorough; surface parties, seismic crews, and finally the drill all came up with optimistic pictures. Lying in the northeast portion of the Colville geosyncline, the Gubik anticline is believed to be about 12 miles long (east-west), and about 2½ miles wide.

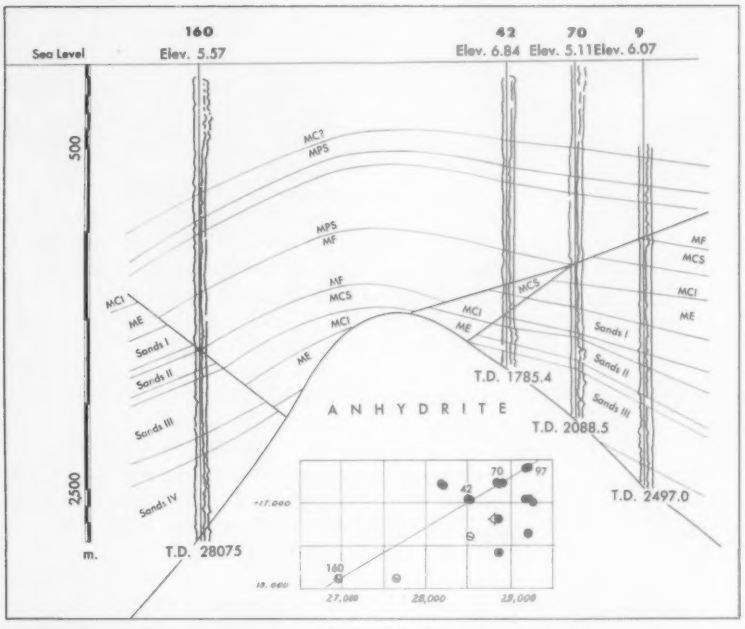
Two tests, Gubik No. 1 and Gubik No. 2, were drilled in 1951. The first well was located near the top of the structure and went to 6,000 ft. Shows of both oil and gas were found at 1,205 ft., and at intervals 3,443-45, 3,519-3,702, 4,261-4,543, and 5,209-5,646 ft. It was estimated to be good for 3,384 M.c.f. gas per day when finished on August 11. The second well was 4,000 ft. southeast of No. 1; it was aimed at finding oil in the sands that bore gas in No. 1. It was 240 ft. downstructure from that first test. At a depth of 4,620 ft. it blew out, caught fire, and was destroyed on December 14. It found no oil, except for minor shows, but had plenty of gas potential.

Geologists believe that reservoir conditions at Gubik will outshine those at Umiat oil field to the west; the U. S. Bureau of Mines recently tagged Umiat as a 120-million-barrel field (primary recovery). At Gubik, core analyses of the reservoir rock have indicated a porosity of 10-22% and permeability of 0-3.78 darcies.

In view of these temptations, the bidding for Gubik land should be brisk. And once development gets under way, we'll see some vast changes in the Alaskan way of life. These will be the northernmost operations on the North American Continent, and with their success will come a new era in American living.

PART 2 (Conclusion)

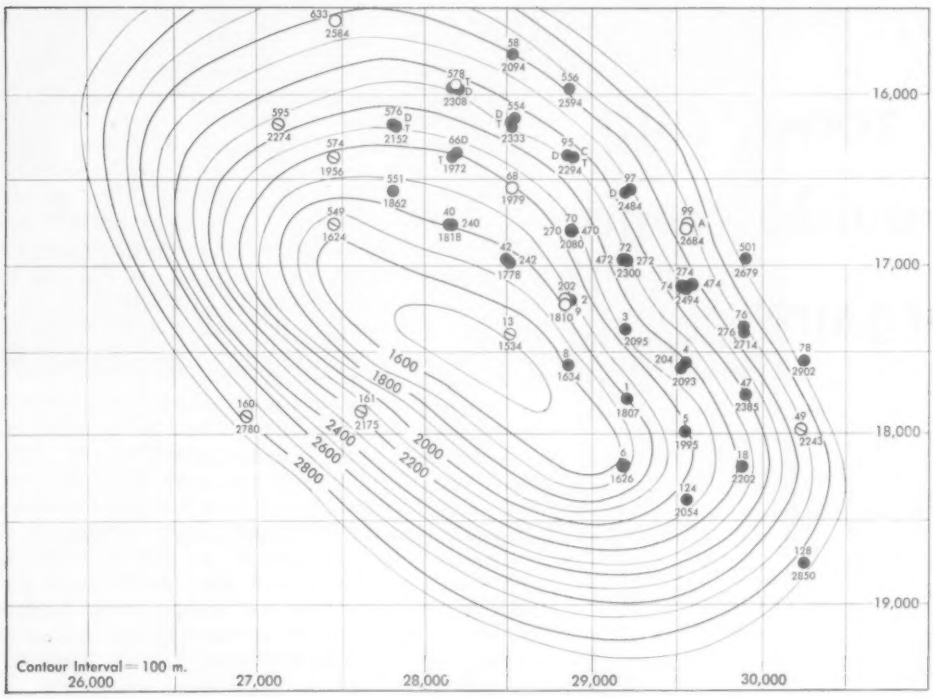
Tehuantepec oil domes may mark potential oil territory for Mexico



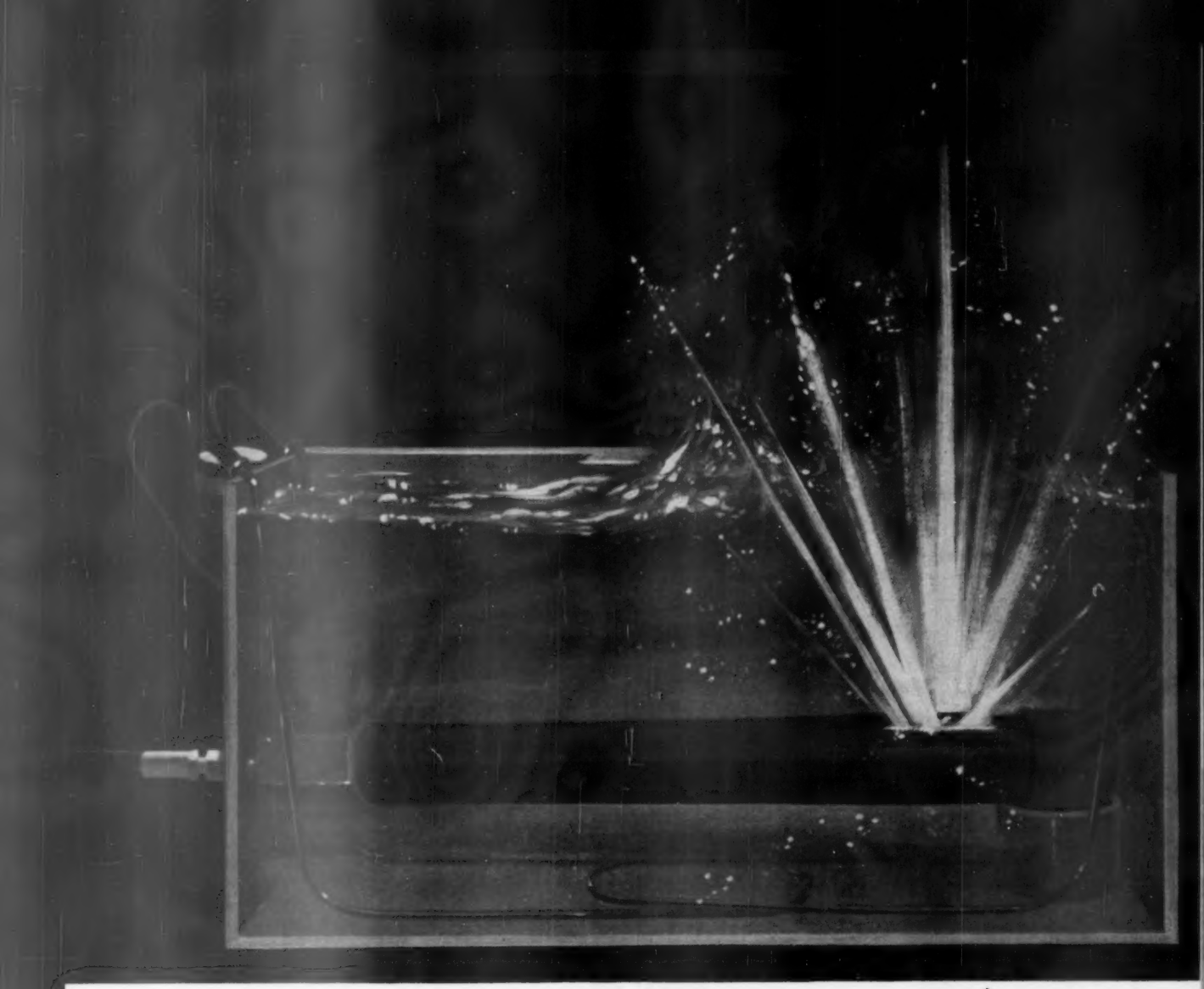
A SOUTHWEST-NORTHEAST cross-section across the Ogarrio field shows the production on the northwest flank.

Written by **Roberto Gutierrez Gil**, district geologist, southern district, and translated by **Lauro A. Yzaguirre**, district geologist, Reynosa district, Petróleos Mexicanos.

The discovery of salt as a result of the drilling of the first wells in this area gave rise to the use and subsequent identification of the area as the Saline basin of the Isthmus of Tehuantepec. This basin is limited on the south by the Sierra Madre anticlinorium, to the east by the San Andrés massif, to the north, as yet unlimited due to the recent discovery of new salt domes and associated structures, and to the northwest possibly by the Northern Chiapas anticlinorium. Recently structures such as Medellín and Jalupa were found to be salt bearing; the Ticul well in the Peninsula of



STRUCTURE of the Ogarrio field is contoured on top of the anhydrite.



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Yucatán drilled through a thick anhydrite section with interspersed salt layers. These wells greatly increase the probable area of the salt basin.

To define the age of the salt we must take into consideration the fact that it has been found intruded through Miocene, Oligocene, Eocene and Upper Cretaceous formations. On the Chinameca dome fossiliferous limestone of Upper Jurassic age have been found above the salt while on the Medellin and Ixhautlan domes red sandstone has been cored within the salt. As a result it may be reasoned that in many wells the salt is pre-Upper Cretaceous in age and in Chinameca pre-Upper Jurassic and may be contemporary to the red beds. The age of the red beds has not been precisely defined, but near the Guatemalan border they have been observed unconformably overlying beds of Middle Permian age. The red beds are the only ones which suggest an arid condition under which salt could have been deposited, but no anhydrite or gypsum has been observed in the area.

Geologic History

During the Permian the seas extended to the south and possibly covered the Isthmus. The Permian sediments were probably derived from a near land mass and the sea extended to Tehuantepec as an arch with north-northwest to east-northeast branches extending as far as Tapachula, Chiapas, where considerable sediments of Permian age have been identified. The land mass which now forms the southern part of the Isthmus basin was probably derived from Permian sediments. An extreme metamorphism existed, since intrusive gneisses are found in the southern part of the Isthmus and serpentine intrusions to the east near Niltepec, Oaxaca. The metamorphism caused migmatization of the sediments. These metamorphosed sediments indicate that the seas were shallow since many of the schists originally were carbonaceus limestones.

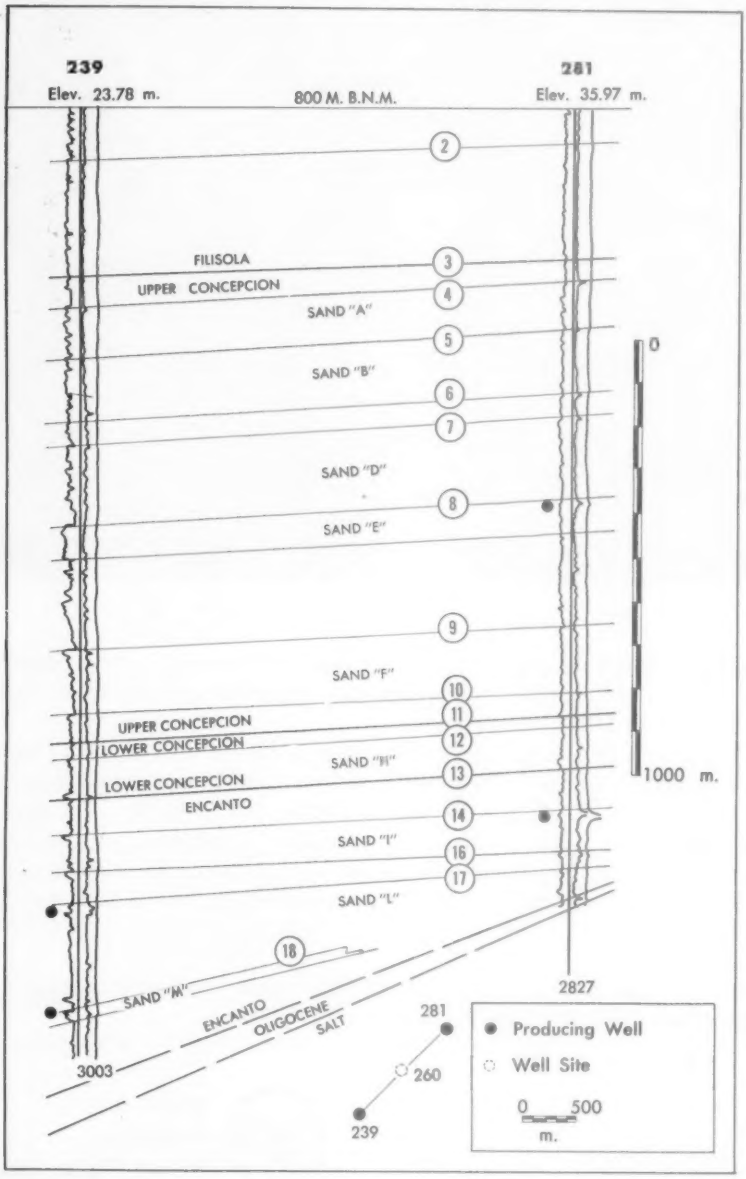
At the end of the Permian or during the Triassic, the area was probably uplifted rapidly and the red beds were derived from the uplifted area. High mountains were formed which impeded the flow of moist air and this maintained an arid climate.

The Northern basin was probably sealed off by the San Andres and Teziutlan massifs which have been inferred to be remnants of Llanoria.

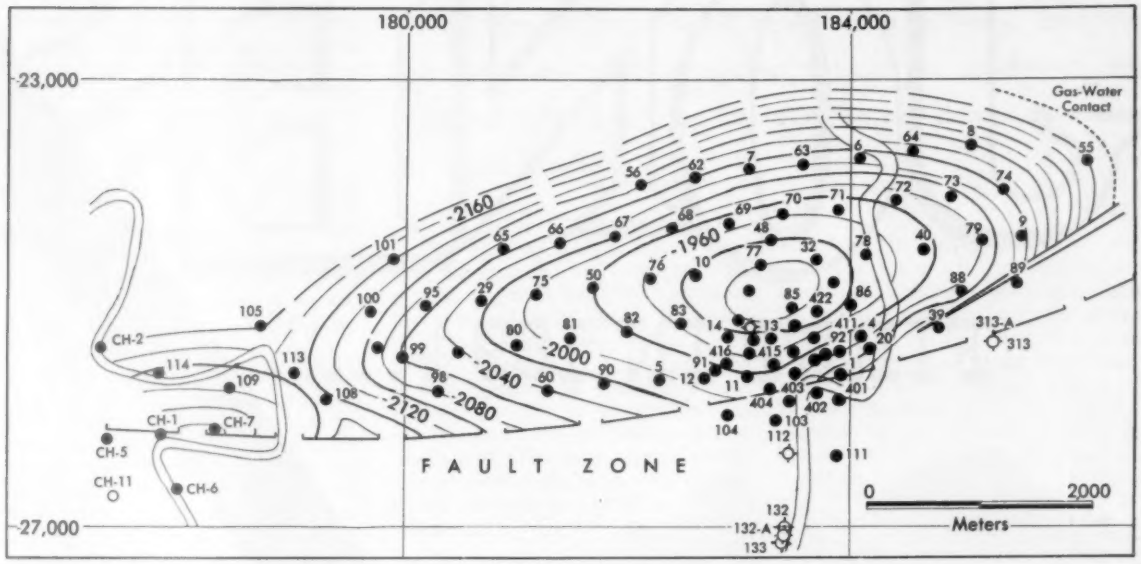
During the Triassic and Jurassic the conditions were favorable for the evaporation of the sea and during this time approximately 2,000 m. of salt were deposited. Data indicates that the maximum salt development was in the area of Coatzacoalcos. A barrier probably existed to the west near Villa Hermosa and beyond it. Salt was deposited to the southeast of Macuspana (Medellin) in amounts inferior to the Coatzacoalcos area. The Yucatan peninsula acted also as a barrier to the inland sea and thus permitted the formation of anhydrite and salt as found in the Ticul well. It is very probable that deep-seated domes originated many of the structures of the Macuspana basin as indicated by the typical faulting observed on them.

It may be assumed that at the beginning of the Cretaceous, Llanoria subsided and was covered by the sea. The Saline basin also probably subsided but this hypothesis is difficult to substantiate due to the absence of the Middle Cretaceous, which could be explained by a partial uplifting of the area which did not permit the deposition of sediments of this age.

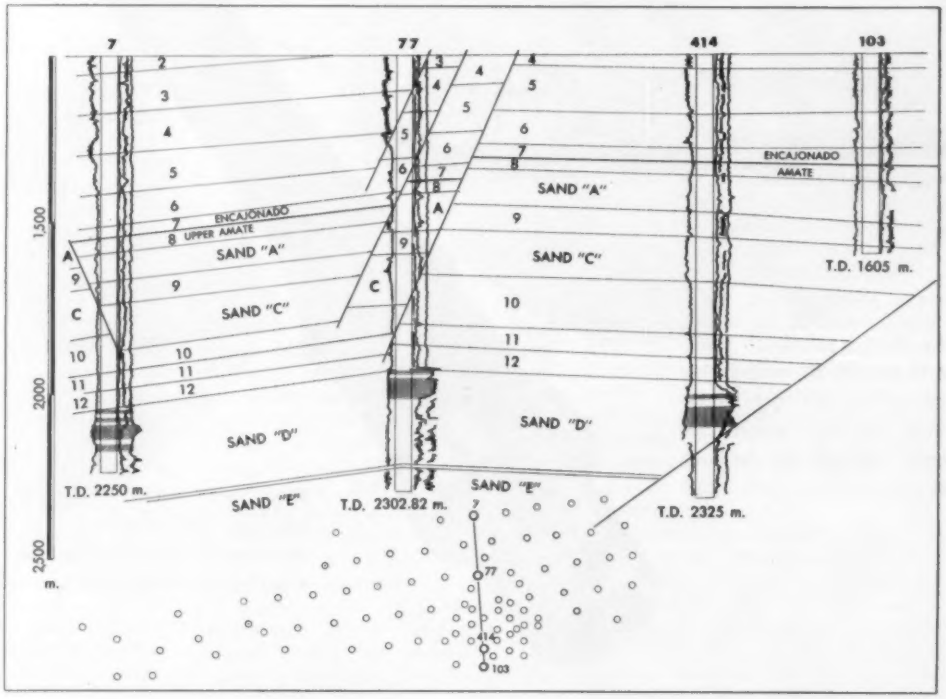
At the beginning of the Upper Cretaceous the entire basin area subsided and shales and sandstones were deposited with much of the clastic material probably originating from a southern-lying land mass. At the end of this period a well defined basin was formed with a geosyncline along the front of the mountains in what is



IN THIS SECTION a well drilled nearly midway between the two shown in the Santa Ana field is likely to get production in any of the possible zones marked plus the Encanto.



STRUCTURE CONTOURS are on top of the "D" sand at the Jose Colomo field.



A NORTH - SOUTH section of the Jose Colomo field depicts complex faulting pattern.

today the coastal plain of Southern Tabasco and Central Chiapas.

The Eocene age began with the subsidence of the lands to the south thus permitting the seas to transgress the Cretaceous limestones. During the Middle Eocene an uplift of the Chiapas massif occurred and considerable amounts of clastics were deposited in the Saline basin. These sediments thin rapidly to the north.

During the Oligocene the basin continued to subside and the domes to grow. At the end of the Oligocene or beginning of the Miocene, the southern rim was transgressed and Miocene sediments were unconformably deposited in the older beds.

During the middle Miocene (Filisola) the basin began to be uplifted slowly and lacustrine and near-shore sediments were deposited; also marine transgressions such as the Aguegues-quite are inferred.

The Cascadian revolution folded the area to the front of the mountain ranges affecting the sediments from the Miocene to the Jurassic.

Structures

The structures observed in the Saline basin are typical salt domes in some instances and in others have a domal or irregular shape, aligned or unaligned disposition which may be the result of deep salt masses.

In the eastern area the structures are unassociated and many, for example Zanapa, have a perfect circular

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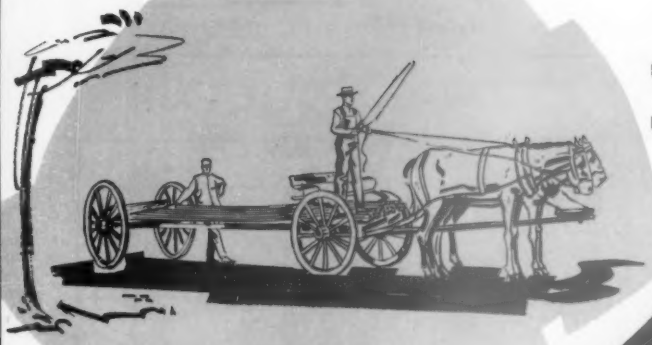

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domal characteristics with diameters reaching 3 kms. Seismically, the records indicate a salt dome which was verified as such by drilling. The salt mass is almost a perfect dome, wider at the bottom, and slightly inclined toward the north.

The annular syncline around the dome is well indicated by seismic work. The fact that the dome underlies this syncline, well defined and circular, shows it to be a central dome which is surrounded by secondary domes such as El Plan, Los Soldados, and Ogarrio.

To the east, other domes such as Acalapa and Tortuguero exist but their relationship to the salt is as yet obscure. To the west there exist complicated structures such as Moloacan Ixhuatla, Nuevo Teapa, and Santa Rosa whose dimensions reach 30 by 3 kms. The Jaltipan dome which is elongated to the northeast and southwest, is probably associated with others in the area and it is on domes such as this that sulfur is being obtained.

To the south of the Uzapanapa River there are many connected domes with diverse orientations. This is an area of a great salt mass which extends to the west as far as Medias Aguas, but the available data are scant and as a result it is not precisely known what the relationship between the domes may be.

It may be concluded that the domes were formed due to the flotability of the salt mass as a result of differential compaction. The principal zones of folding in the Medias Aguas-Coatzacoalcos areas were oriented to the northwest-southeast with axis almost perpendicular to the mountain folds of the Southern Sierra Madre. It must be assumed that the folds were formed against the resistance of a massif existant in the area of San Andres. In many instances this orientation is more apparent than real and was measured by surface geology and not on the salt intrusions. The intrusions were probably formed by the static thrust of the sediments over the salt if the following reasoning is taken into consideration:

1. On no salt domes have large overthrust faults been found that indicate intense folding.

2. Along the southern edge of the salt basin a regional syncline, called Fortuño, extends from Cerro Nanchital as far as Achotal. This syncline which outcrops in the lower Miocene limits the Limas, Chichonal, Nopalapa, Manati, Coapiloloya, Encantada, Moralar, Medias Aguas, and Achotal domes, is not parallel to the Sierre Madre or the San Andres massif.

"If the San Andres massif acted as a bulwark, and the sediment were pushed against it from the southwest, the principal folds should be found in the salt domes closest to the Sierra Madre."

3. If the San Andres massif acted as a bulwark and the sediments were pushed against it from the southwest, the principal folds should be found in the salt domes closest to the Sierra Madre. The folding is not indicated in that manner, but is oriented from the northwest to east while the salt masses are oriented primarily north-south. The large domes of the western part of the basin were formed by the compaction of the salt by the sediments.

Structure of the Macuspana Basin

The Macuspana basin is second in importance from a production viewpoint. Numerous structures have been located and drilled, but only one, Medellin, has been proved a salt dome. The district has been divided, for descriptive purposes, into two halves, northern and southern, using a line between Villa Hermosa-Vernet-Colomo as a marker.

The southern section is characterized by northwest-southeast-oriented folds which dip to the northwest and parallel the Sierra Madre. Some of these, such as Encarnacion, Amate Barrancas, and San Antonio, have dips as high as 45° and in the latter the Eocene sediments are vertical with Amate Barrancas having a slight recumbency to the southeast. Parallel to these structures is Fortuna Nacional with 40° to 60° dips and a highly complex fault pattern. To the east in the area the structures change in strike from east to west with 30° to 50° dips and slightly recumbent to the north-northeast.

It is assumed that Coco, Macuspana, Encarnacion, Amate Barrancas, San Antonio, Sarlat, and others owe their folding to the thrusts that formed the Sierra Madre.

In the eastern part of the southern area the anticlines were probably formed as a result of the orogeny that occurred in Guatemala since they are more gently folded and parallel, with soft dips, in contrast to the highly folded structures of the rest of the area.

The second or northern section of the Macuspana basin includes the most important fields which are located on the east-west-trending structures. Towards the Bitzal, Cobo, Cantemoc, Hormiguero, Palizada, and Xicalango structures, the trend is variable and they are irregularly oriented to the southwest, northeast, north and south or almost perpendicular to the Sierra Madre. The changes may be due to the local conditions of the initial folds being modified by deep salt intrusions. In this area there is noted a decided increase in the Miocene section in comparison to the same sediments of the southern area.

Comalcalco District

The first commercial oil in the Comalcalco District was discovered in 1958 on the Mecoacan and Tupilco structures. The area is to the north of what had previously been considered the Jalapa massif which limits the eastern edge of the salt basin and is associated structurally to the Chiapas anticlinorium. The structures of the basin are oriented northeast-southwest and perpendicular to the anticlinorium in the west, in the north, structures such as Mecoacan and North Tupilco are oriented east-west, while in the east they are aligned parallel to the northern part of the anticlinorium.

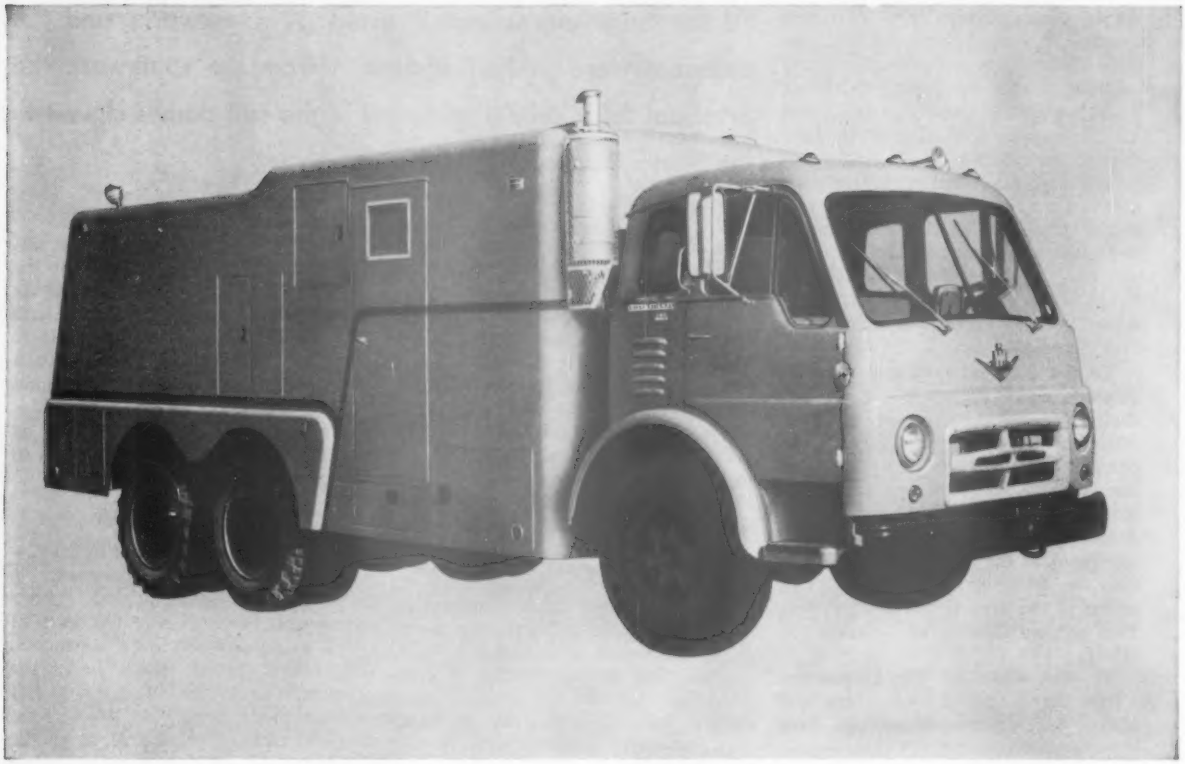
On the north and northwest structures of the area the Miocene is over 3,000 m. thick with well-developed oil-producing sands in the Amate formation. On the northeast and east structures, the frontal folds of the anticlinorium have a thinly developed Miocene section of 600 to 800 m. and a greatly diminished sand section is observed.

As of this date Petroleos Mexicanos has discovered commercial oil production on the Cardenas, Peluzal, Aleman, Encrucijada, Comalcalco, Mecoacan, and Tupilco structures and is at present drilling the East Mecoacan and Aldamas features. To the east the Jalpa, Macuiltepec and Tamulta structures have not produced, due probably to a diminished amount of Miocene sands in the Upper and Lower Amate.

Petroleum Development of Saline, Macuspana, and Mecoacan Areas

Since 1906, when drilling activity commenced, through July 1959, 1,511 wells have been drilled and 32 fields discovered.

The oil accumulation associated with salt domes corresponds in its minor quantity to the caprock and its major volume to flank sands. During the



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last 30 years no caprock production has been obtained. Some production has been obtained from the overlying Cedral and Paraje Solo sands of the Upper Miocene. As stated, the greater portion of production is obtained from the flanks in sands of the Lower Miocene-Encando and lower Concepcion formations.

The flank production of the domes is limited and controlled by faulting along the strike of the affected sands. Some of the accumulation is due to wedging of the sands against the salt or around the dome before reaching the core.

On some of the recent discoveries in the northeast part of the Saline basin, the production was found on the flanks of such structures as La Venta, Magallanes, and Ogarrio in the thick Miocene-Encanto sands which range from 150 to 200 m.

As a typical example, the Ogarrio structure is described. It was discovered in 1958 as a result of reflection seismic exploration carried out by Pemex in 1953 and was mapped as a semidomal feature with a north-northwest south-southeast axis. During April of 1957, Pemex drilled its first well which cut 1,812 m. of Miocene and penetrated the anydrite at 1,812 meters. As of July of this year, 59 wells have been drilled and 49 produce, mainly through dual completions, 13,530 bbl. of oil per day. To date the reserves are estimated at 57,456,000 bbl. of oil and 6,628,800 bbl. of distillate to be obtained from the gas. The dome measures 5 by 3 kms. with a northwest-southeast orientation and an abrupt southwest flank which dips at a 60°-70° angle while the northeast flank dips at the rate of 30°-40° and is modified by numerous faults which control the typical salt-dome accumulation. Two important faults affect the structure: A southern one which crosses the structure diagonally and has a throw more or less parallel to the axis and a northeast downthrown fault on the southeast portion of the structure which limits the field. At present the discovered accumulation is concentrated on the northeast flank. Numerous secondary faults, downthrown to the southeast exist. The opposite flank is still open to exploration regardless of two dry holes which were drilled. A transverse section indicates the productive sands which in some wells total 90 m. in thickness.

Marine Exploration

As of 1949, marine seismic exploration began offshore which indicated the presence of numerous structures, two of which, Rabon Grande and Tortuguero, were oil and gas productive. During 1957 some of these structures were detailed using the latest seismic equipment available.

The result of these two periods of marine work was the drilling of the Tortuguero dome which trends southwest-northeast for 8 kms. which obtained greater gas production from the Lower Miocene sands. The Rabon Grande structure was interpreted as having a shoreside feature which was drilled both vertically and directionally from the coast and resulted in additional production, up to 7,000 bbl. per day from lower Miocene sands. Later work indicated offshore closures oriented southwest - northeast, faulted, and with 25° dips on the flanks. Various wells were drilled offshore with negative results on a secondary closure. Drilling results offshore do not preclude the possibility of developing better production in the area.

The offshore structure known as Santa Ana which is now being developed by the Pauley group in a piercement-type dome or diapir fold oriented east-west with steeply dipping sides and a secondary flank high separated possibly by southwest-northeast-trending faults. Drilling is still being carried on over this secondary high from which oil production was obtained in the Encanto between 2,657-69 m. and 2,889-2,904 m. A minimum

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average daily production of 400 bbl. per day is anticipated. These wells drilled approximately 3,000 m. of Miocene strata. This high measures roughly 4 by 7 kms. and has 7 oil zones: 4 in the Concepcion Superior and 3 in the Encanto with sands to date totaling 75 m. At the present an estimated reserve of 675,000 bbl. is present but this figure should logically increase as more wells are drilled. Besides the above structures, 10 others have been located between Coatzacoalcos and Cd. del Carmen which remain to be tested.

Production

The 23 fields of the Saline basin have an accumulated production of 251,368,138 bbl. of oil as of July 1959 while the reserves, as of the same date, are as follows:

1. **Oil:** 191,525,000 bbl.
2. **Distillate:** 15,487,420 bbl.
3. **Gas:** 166,199.3 M.M.c.f. (166 billion).

The Macuspana basin, from nine fields has an accumulative oil production of 18,185,683 bbl. with reserves, as of July 1959, as follows:

1. **Oil:** 103,111,175 bbl.
2. **Gas:** 2,267,181 M.M.c.f. (2.267 trillion).

Within the Macuspana basin, the most important productive feature is the José Colomo structure which is located 50 kms. to east of Villahermosa, Tabasco. This structure oriented east-west, is associated with a secondary feature called Chilapilla and are separated by a syncline. They total 360 m. of producing sands which are separated by thin shale streaks. The syncline produces due to the thickness of the sand bodies.

The Colomo structure which has domal form, 2.5 kms. wide, is affected by numerous faults which strike northwest, southeast, east, or west with displacements varying from 30-100 m. and downthrown generally to the southwest. These faults affected only the accumulation in the upper sands. Fault 1, oriented east-west, and downthrown to the north, as well as another fault, cause the structure to fall in a graben while other faults limit the southern part of the field. José Colomo 1 discovered the field in 1951 and was carried to 1,700 m., rough Pliocene and Miocene sediments with very thick sand bodies as stated above.

Through July of 1959, 98 wells have been drilled: 90 producers and 8 dry. Presently the field produces 583 bbl. of oil from the upper zone and 278 million cubic feet of gas, which, after processing, produce in the Cd. Pemex absorption plant 13,900 bbl. of products. The plant will be increased 50% from its 300 M.M.c.f.d. capacity to supply the Mexico City gas line now under construction.

The recoverable reserves of Colomo field are estimated at 2.4 million bbl. of oil and 97.5 million bbl. of distillate with gas reserves estimated at 2.2 trillion cubic feet.

Other structures in the basin such as Vernet, the recent discoveries (August 1959) of Hormiguero and Cobo, hold great promise of developing greater reserves.

The Comalcalco basin development dates from the discovery of the Mecoacan and Tupilco structures as oil features. The structures as indicated previously are lightly folded but very highly faulted.

The Mecoacan structure, an almost symmetric anticline, oriented east-west, 11 by 3 km. in area has two highs. The first well which was drilled to 2,600 m. through Miocene sediments produced 266 bbl. from the Amate Superior sands. To date, 6 producing horizons totaling 75 m., have been discovered by the 9 wells drilled and production has reached 3,200 bbl. per day. The faults indicated have throws up to 900 m. and have faulted the Encajonado and upper Amate together.

At the present a well is being drilled on an eastern downthrown block.

The Tupilco field was discovered recently and is still in the progress of development and as such it may only

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be said that it promises to be another important producing area.

Acknowledgement

This paper has been prepared with the help of Hugo Contreras, exploration superintendent of the Southern district, and Enrique Sansores, geologist of El Plan field, to whom the writer is greatly indebted. Antonio García Rojas, exploration manager of Petróleos Mexicanos, authorized this presentation, which is greatly appreciated.

Geological field work slated for Alaska

BP Exploration Co. (Alaska), Inc., intends to employ a party of three geologists plus three assistants in Alaska during the summer of 1960.

The company has been granted leases on about 50,000 acres in the Umiat region and has options on a further 120,000 acres in the Umiat and Gubik areas plus a small area in the Copper River basin in the south.

BP has also taken an interest in a deep test well being drilled by Paul G. Benedum in the Nulato basin, adjoining the Yukon River in western Alaska.

Current Alaskan report shows six wells going

During the first week of February there were half a dozen wells drilling in Alaska. Benedum & Associates 1 Nulato in SW¼ 7-10s-2eK.M. was at 3,651 ft.; Richfield Oil Corp. 1 Kaliakh at Katalla in the Yakataga basin, SW¼ 34-20s-14e C.R.M. was at 9,983 ft.; at Cook Inlet basin, Standard-Richfield's Kenai Peninsula activity included 14-27 Swanson River in SW¼ SW¼ 27-8n-9w S.M. at 8,373 ft.; 23-22 in NE¼ SW¼ 22-8n-9w S.M. at 9,340 ft.; on Soldatna Unit, 41-4 in NE¼ NE¼ 4-7n-9w S.M. was at 8,883 ft.

Cold weather boosts drilling action, keeps British Columbia rigs busy

BRITISH COLUMBIA established a new drilling activity record in February, and if the weather man cooperates and keeps the temperatures low in this current hot spot of western Canada's oil and gas play, the current total of 45 active rotary drilling rigs may be pushed even higher during the next few weeks. Canada's West Coast province holds the spotlight at present with its new high in drilling operations and its many extremely interesting drilling plays.

Fifteen separate oil and gas exploration and development companies are operating drilling equipment in the province at present. The 45 active rigs are owned by 18 different drilling contracting firms.

Activity up. Current rate of activity, which shows 12 development

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wells under way and 33 wildcats making hole, is a 25% increase over activity of 1 month ago.

British Columbia's activity coupled with the near-record rate of operations in Alberta, has put almost every available 6,000-12,000-ft. rig to work.

The previous "feast or famine" that has been common to the oil and gas industry of B.C. during the past number of years may become much more stable in 1960. Due to the relative youngness of the industry, the inaccessible ground conditions during many months of the year, and the distance most of the area lies from markets, the province's drilling play has been crammed into the few winter months when operators find it much more convenient and much less costly to move equipment across the frozen tundra. A number of contributing factors could stretch the drilling season over the entire 12-month period, if not this year, then within the next few years. Some of the major factors that may end the trend of previous years include: Larger export of natural gas that would call for additional development and improvement of road facilities; oil-pipeline construction that would allow movement of the province's producible potential to be marketed outside of the immediate exploration; and further development of tracked equipment capable of moving drilling equipment during summer operations.

Development should rest. Although exploration operations are not expected to continue at the present high level for more than a month or so, all three of the previously mentioned factors may be implemented this year. With recent increases in wellhead gas prices more development is almost assured and this will add the reserves necessary for export. The B.C. Government has already approved the permit to contract an oil line from the major oil areas of the province and here again construction is imminent. As far as movement of equipment is concerned the first rig move ever during summer was completed in the northern sector of the province in late 1958 or early 1959.

Sinclair leads. Sinclair Canada Oil Co. presently heads the list of operators in British Columbia as it has eight rigs operating under its direction. Six of the units working on its behalf are on wildcats while two are on development holes.

Pan American Petroleum Corp. is second on the list with six rigs at work, all on wildcat tests, while Pacific Petroleums, Ltd., pioneer of gas exploration in this region, is in third position with five rigs at work. Phillips Petroleum Co. of Bartlesville, Okla., has four rigs at work, as has Texaco Exploration Co. Each of these two firms has one rig on development work and three on wildcats. Sun Oil Co. of Canada and Union Oil Co. of California are tied with three rigs each, with Sun's all on development wells and Union's including one on development and two on exploratory tests. Companies with a pair of rigs active include Dome Petroleum, Ltd., Hudson's Bay Oil & Gas, Ltd., Triad Oil Co., Ltd., and Woodley Canadian Oil Co., while Amerada Petroleum Corp., Calvan Consolidated Oil & Gas (one of the Canadian Fina group of companies), Gulf States Oil Co., and Imperial Oil Ltd, all have a single unit operating at present.

Boundary Lake busy. With regard to interesting plays about 15 of the active rigs are situated in the general Boundary Lake area and are therefore primarily interested in oil development or discovery.

Kotcho Lake area. Unlike other areas of western Canada, British Columbia has been the scene of a very active search for natural gas and no program in this regard was ever more intense than the present search in the general Fort Nelson region of northern British Columbia. Sparked by Gulf States Oil Co. of Canada's discoveries at Petitot and Kotcho Lake interested parties are drilling close to those fabulous strikes and in other promising regions between Fort Nelson and the boundary of the N.W.T. Only more significant gas discoveries will assure markets for present reserves and on the basis of this year's projects it can't be very long before a tube of steel is stretched from the Jedney-Pejay region north to Fort Nelson. The first followups to Petitot and Kotcho have come in and apparently are successful and now new tests have been staked in both of these gas areas.

Important link test slated in Major County

Northwestern Oklahoma's Major County will get an important link test at Livingston Oil Co. 1 Wineteer in SE NW 23-22n-11w, 6 miles west of Ringwood.

The well would link four Major County producing areas should it be completed successfully. Its location lies 1½ miles east of West Forrest Home pool, 2 miles west of East Forrest Home field, 2 miles south of Northwest Ringwood field, and 2 miles north of Ringwood field. Operator will take the well to 7,000 ft.

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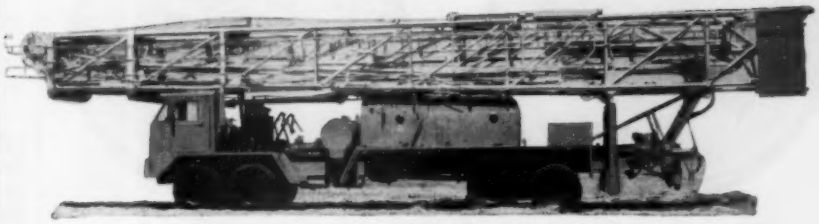

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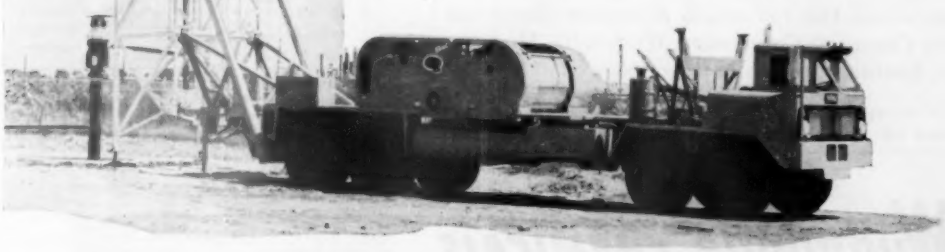

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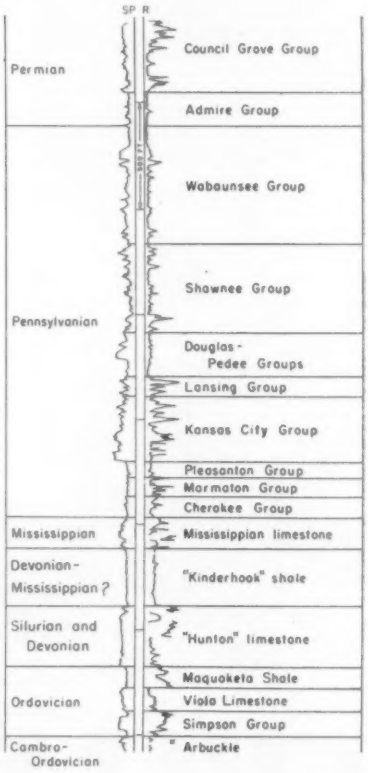
Two strikes into Kansas

THE discovery of Geary County's first commercial oil well in October 1959 prompted accelerated exploration in that county, and in December 1959 a second producing area was discovered. Accordingly the demand for available geologic data on the region has become insistent.

Geologic Setting

Geary County is situated on the eastern flank of the Salina basin, where outcropping Permian rocks, displaying more than 350 ft. of topo-



ELECTRIC LOG shows the typical stratigraphic section in Geary County, northeastern Kansas. Formations from Arbuckle through the Council Grove group of Permian age are represented in the area. Fig. 1.

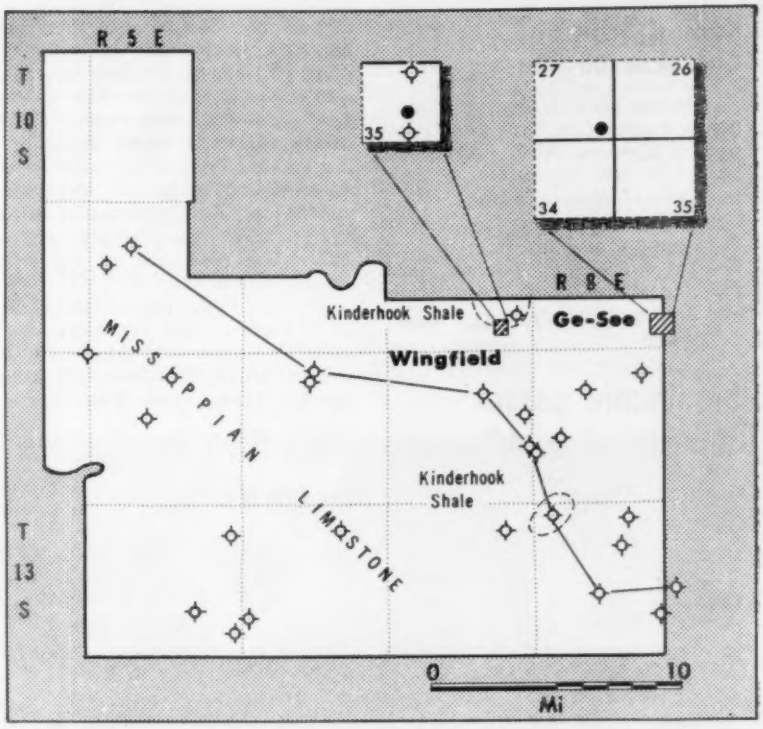
put Geary oil picture

BY PAUL L. HILPMAN AND EDWIN D. GOEBEL
Oil and Gas Division, State Geological Survey of Kansas

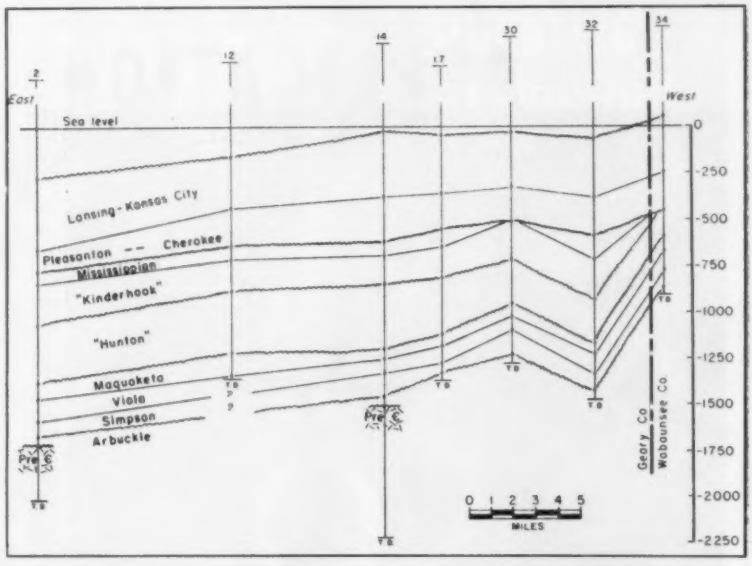
graphic relief, dip gently to the west. Pennsylvanian rocks beneath them overstep Mississippian formations eastward; Mississippian rocks are absent from structural highs in eastern Geary County. Fig. 1 interprets the characteristic "kicks" on an electric log from a well in the eastern part of the county where the stratigraphic section is more nearly complete. Fig. 3 is a northwest - southeast cross - section across Geary County. Oil from Ge-See field is being produced from a Pennsylvanian sand near the Pennsylvanian - Mississippian unconformity and Mississippian oil production is reported from Wingfield field.

Ge-See field, in the northeastern part of Geary County and extending into Wabaunsee County, is about 2 miles southwest of Yaege field in Riley County. Wingfield field, 6 miles west of the Ge-See field, lies on the flank of a separate pre-Pennsylvanian structure. As yet no official state productivity tests have been run on the discovery wells of these two fields.

NORTHWEST-SOUTHEAST cross-section across Geary County, Kansas, is keyed at bottom of page. Ge-See produes oil from a Pennsylvanian sand near the Pennsylvanian - Mississippian unconformity. Wingfield has reported Mississippian oil production. Fig. 3.



GEARY COUNTY, KANSAS, shows pre-Pennsylvanian areal geology, producing oil fields, and dry holes. Fig. 2.



Key to cross-section →

12. Pay Rock Oil Co., Inc. 1 Johnston, CEL NE NE 9-12-6e. 12-12-49. Surface elevation 1,310 ft. Top of Lansing at 1,460 ft., base of Kansas City 1,732 ft., Mississippian 1,943 ft., Kinderhook 2,019 ft., Hunton 2,182 ft., Viola 2,636 ft. TD 2,660 ft.
14. Pioneer 1 Chase, SEC SE 10-12-7e. 1-15-29. Surface elevation 1,412 ft. Top of Lansing 1,425 ft., base Kansas City 1,778 ft., Mississippian 2,015 ft., Kinderhook 2,095 ft., Hunton 2,250 ft., Viola 2,660 ft., Simpson 2,730 ft., Arbuckle 2,860 ft. TD 3,638 ft.
17. F. G. Holl et al. 1 Iseli, NW NW SE 24-12-7e. 1-9-52. Surface elevation 1,280 ft. Top of Lansing 1,324 ft., base Kansas City 1,636 ft., Mississippian 1,830 ft., Kinderhook 1,925 ft., Hunton 2,096 ft., Viola 2,471 ft., Simpson 2,560 ft., Arbuckle 2,605 ft. TD 2,656 ft.
30. F. G. Holl 1 MacArthur, SWC Lot 18, 6-13-8e. 12-10-59. Surface elevation 1,427 ft. Top of Heebner 1,248 ft., Lansing 1,458 ft., base Kansas City 1,759 ft., Kinderhook 1,938 ft., Hunton 2,149 ft., Viola 2,465 ft., Simpson 2,536 ft., Arbuckle 2,665 ft. TD 2,682 ft.
32. Continental Oil Co. 1 Germann, SE SE NW 20-13-8e. 3-30-53. Surface elevation 1,472 ft. Top of Heebner 1,325 ft., Lansing 1,532 ft., base Kansas City 1,850 ft., Mississippian 2,062 ft., Kinderhook 2,183 ft., Hunton 2,407 ft., Viola 2,712 ft., Simpson 2,812 ft., Arbuckle 2,906 ft. TD 2,958 ft.
34. Continental 1 Falk, SW SW NW 23-13-8e. 1-27-53. Surface elevation 1,497 ft. Top of Heebner 1,250 ft. Lansing 1,434 ft., base Kansas City 1,740 ft., Hunton 1,948 ft., Viola 2,170 ft., Simpson 2,240 ft., Arbuckle 2,365 ft. TD 2,401 ft.

Kansas' Scott has Cherokee oil find

Cherokee Pennsylvanian oil production was opened in Scott County last week at Kewanee Oil Co. 1 Wasinger "A," NW NW 12-20s-33w, 5 miles southwest of Shallow Water.

The discovery pumped 47 bbl. of 28.2°-gravity oil daily from perforations at 4,618-23 ft. The new field, the county's fourth, is called Northeast Shallow Water field.

Significant gasser completed in Alberta

ANOTHER important development well has been completed in the Pincher Creek gas field by British American Oil Co.

The B. A. 10-2 Pincher Creek, at LSD., 10 2-4-29w4, during production tests in the Rundle, flowed at a stabilized rate of 35.2 M.M.c.f.d. of gas through 3-in. tubing with a flowing tubing pressure of 770 lb.

The top of the Rundle was 12,026 feet and 253 feet of gross pay was encountered. Total depth of the well was 12,279 ft.

The well has a gas-condensate ratio of 23.5 bbl. of condensate per million cubic feet of gas.

The 10-2 Pincher Creek development well compares favorably with the recently completed 9-10 Pincher Creek development well which, during production tests flowed at rates up to 40 M.M.c.f.d. of gas and had a calculated open-flow potential of 201.1 M.M.c.f.d. of gas. The new well is 1¼ miles southeast of the 9-10 Pincher Creek well.

The 10-2 Pincher Creek well is one of 12 Pincher Creek field wells which presently supply 135 M.M.c.f.d. of residue gas to the Alberta gas trunk line for Trans-Canada Pipe Lines.

Gas find for B.C. is confirmed

IN BRITISH COLUMBIA, Pacific Petroleums, Ltd., has confirmed a new Mississippian gas discovery in the Pocketknife area.

The well, Pacific Hudson's Bay C-37-L Pocket Knife flowed gas in three drill-stem tests as follows: Test No. 1—7.4 M.M.c.f.d.; Test No. 2—8.3 M.M.c.f.d.; and Test No. 3—3 M.M.c.f.d. The third test also flowed water at an estimated rate of 600 bbl. per day. The drill-stem tests cover a 294-ft. interval in the top of the Mississippian Rundle formation which was encountered at 4,979 ft.

The new discovery is on Hudson's Bay Oil & Gas Co.'s Permit No. 966 which comprises 24,581 acres and, upon reaching contract depth, will earn a 25% interest each for Pacific Petroleums, Ltd., and Westcoast Production Co., Inc. The well, which is currently drilling to deeper formations, is approximately 30 miles northwest of the prolific Jedney-Bubbles, La-Prise area.

Colorado oil well is now Dakota gasser

A well in Moffat County, northwestern Colorado, which was formerly a Weber Pennsylvanian oil producer, is now a Dakota gasser. The Cretaceous production was found by Continental Oil Co. at 1 Smith in SE SW 30-5n-98w in Elk Springs field.

Flow was 3,300 M.c.f.d. from Dakota at 3,903-06 ft. The original well was completed back in 1946 for 175 bbl. of oil per day from perforations in the Weber sand at 6,097-6,126 ft.

Elk Springs field is 25 miles northeast of Rangely field. There were three Weber oil wells in the field. Two years ago Dakota gas production was opened by Continental 1½ miles

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southeast of the field. The well had been planned to Weber, but no shows were found. The Dakota gave up 2,120 M.c.f.d. at that 1958 well. Later a southwest extension was completed for 1,500 M.c.f.d. from Dakota. The only Dakota production in this area of Colorado is at Winter Valley, Rangely, and Danforth Hills-Temple Canyon-Maudlin Gulch.

Remote Palo Duro basin test set

A 9,400-ft. wildcat will go down 50 miles from any production in the Palo Duro basin of northwestern Texas. Pan American Petroleum Corp. will drill 1 Mary Lee Robbins in Section 275, Block M-6, SK&K Survey, 10 miles northeast of Dimmitt in Castro County. Nearest production is 50 miles southwest at Littlefield San Andres field in Lamb County.

Spraberry hit reported in Upton County, Texas

The southeast part of Upton County in West Texas has new Spraberry production at Texaco Inc. 1-DG State of Texas, 6 miles northeast of Rankin.

Flow at the new well was 253 bbl. of 39.8°-gravity oil daily through 40/64-in. choke from perforations at 7,274-89 ft. Location is in Section 27, Block 3, University Lands Survey. Location is 2 miles west of Flat Rock field and 3½ miles north of Block 4 Fusselman field.

Three new oil pools in Illinois in January

Three new oil pools, Louisville South in Clay County, Mattoon North in Coles County, and Springfield East in Sangamon County, were discovered in January.

There were also four extensions to pools, three to Mt. Auburn Consolidated in Christian County, and one to Kenner West in Clay County.

A total of 240 wells were completed from December 23, 1959, to February 3, 1960. The completions include 98 oil wells, or a success ratio of about 40%. In addition, three wells that had previously been completed as dry holes were worked over and recompleted as producers, two as oil wells and one as a shut-in gas well.

The discovery of Springfield East pool in Sangamon County has caused much interest and a flurry of activity in the area, which is about 4 miles beyond the edge of previous production in the Sangamon and Christian counties area. The discovery well, the Alladin Oil Co., 1 Scott, 21-2s-4w, was completed for initial production of 528 bbl. of oil a day, flowing through ½-in. choke from Silurian limestone at a total depth of 1,605 ft. Initial production would have been greater without the choke.

Estimated production for Illinois for January is 6,535,000 bbl. of oil.

Good field develops in Warrick, Indiana

The good oil field is being developed 4 miles northeast of Boonville, near Degonia Springs, Warrick County, Indiana. The discovery well of this field, Degonia Springs North, is J. C. Westfall Jr. and Don Moroney 1 Russell Tennyson in SW NW NE 22-5s-7w. It was completed last fall for 28 bbl. of oil and 2 bbl. of water per day, pumping natural. Pay was Cypress Mississippian sand at 1,224-46 ft. Since that time 17 oil wells have been completed and are producing in Sections 15, 21, and 22-5s-7w.

Other basin news. In Spencer County, Indiana, Charles J. Schroll 1 George Foertsch, NE NW NE 31-

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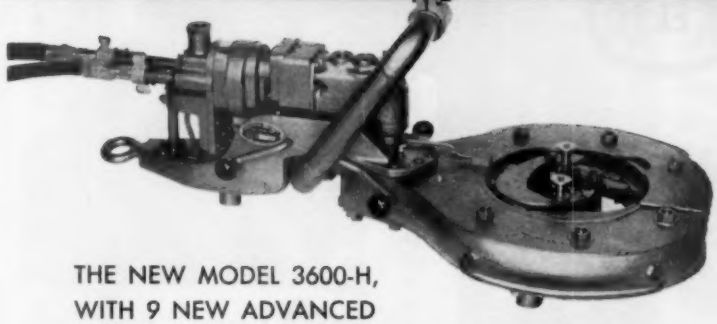

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5s-4w, 4 miles south of Santa Claus, is pumping 20 bbl. of oil per day into tanks from Jackson sand at 719-726 ft.

In Franklin County Illinois, 8 miles north of Benton, John C. Bowers 1 Plains Pipe Line Co. Lease 2, NW SE NW 6-5s-3e, pumped 135 bbl. of oil per day, natural, from Aux Vases Mississippian at 2,792-98 ft.

In McLean County, western Kentucky, 2 miles west of Nuckols in 17-M-29, Chester Humphrey 1 Estil Howard Estate swabbed 240 bbl. of oil in 24 hours after nitro shot in the stray sand at 1,147-81 ft.

A new pumper is reported in Muhlenberg County, western Kentucky, at Stouder Drilling Co.-Ashland Oil & Refining Co. 1 Lelian Scott in 14-I-27, 2 miles southwest of Graham Station. The well made 45 bbl. of oil and no water per day from Paint Creek sand at 1,748-73 ft. after shot. This discovery is ½ mile from other production and 4 miles from nearest Paint Creek sand production.

Discovery wells

SOUTH LOUISIANA

Lafourche Parish:
Union Oil & Gas Corp. of Louisiana 1 Bowie SD Unit 6, 29-13s-17e, southeast flank of Chegby field. IP 244 BOPD, 3,700 M.c.f.d., 8/64-in., 38°, TP 5,000 psi., perf. 11,739-60 ft. TD 12,925 ft. New pay in Chegby field.

NEBRASKA

Scotts Bluff County:
Tom Vessels, Jr. 1 Ewing, C NE SE 26-21n-56w. IPP 170 BOPD, "J" sand discovery, new field. TD 5,718 ft.

NEW MEXICO

Rio Arriba County:
Val Reese & Associates 1-30 Sperling, NE SE 30-24n-6w. IPF 242 BOPD, 745 M.c.f.d., varied chokes, Gallup 5,280-5,358 ft.; IPF 694 M.c.f.d., ¾-in. choke, Dakota 6,402-54 ft. TD 6,535 ft. Dakota discovery, new field.

San Juan County:
Western Natural Gas Co. 1 Keeling, NW NE 20-25n-8w. IPF 107 BOPD, 21/64-in. choke, 39.1°, GOR 1402:1. Graneros-Dakota 6,354-6,570 ft. TD 6,681 ft. Graneros - Dakota discovery, new

EAST TEXAS

Van Zandt County:
R. J. Caraway 1 W. A. McCoy, James Cheshire Sur., A-181, ¾ mile southeast of Fruitvale. IP 3,140 M.c.f.d. (calculated open-flow potential), GOR 164 M.c.f. per bbl., perf., 10,522-32 ft., Cotton Valley; 399 BOPD, ¼-in., 42.1°, TP 784 psi., GOR 1,120 cu. ft. per bbl., perf. 8,286-93 ft., lower Rodessa; and 114 BOPD, 18.64-in., 42.4°, TP 280 psi., GOR 2,889 cu. ft. per bbl., perf. 8,184-94 ft., upper Rodessa. TD 13,563 ft. Triply completed discovery well of Southeast Fruitvale field.

TEXAS GULF COAST

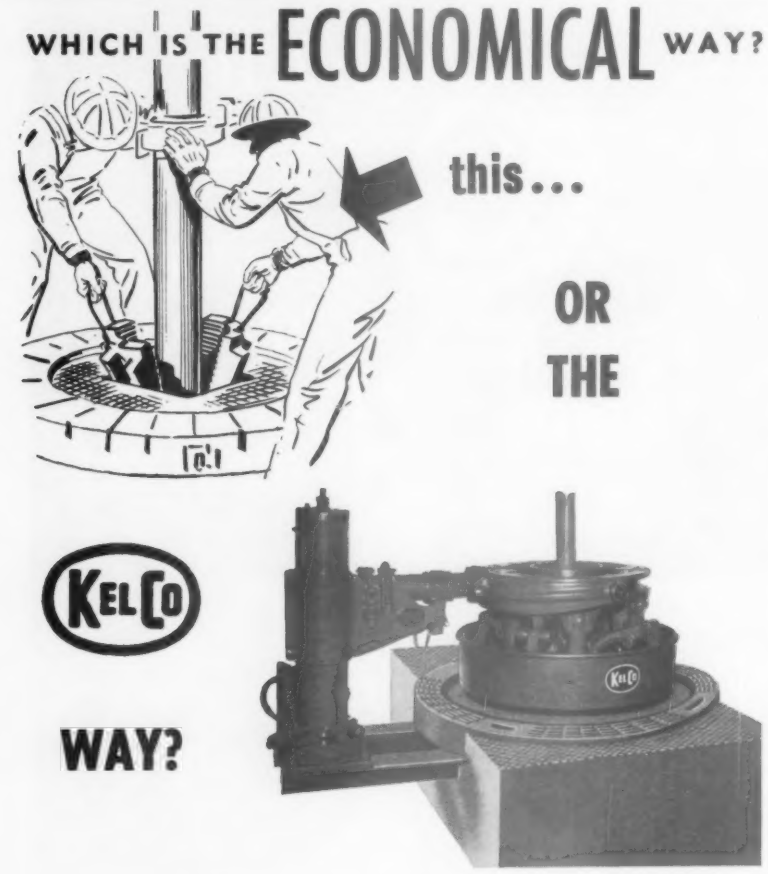
Bee County:
Ray D. Sorrels 1 Alvin Startzenberger, Patrick O'Boyle Sur., A-46, 8 miles south of Beeville. AOF 3,200 M.c.f.d., dry gas, shut-in TP 1,155 psi., perf. 2,824-30 ft. TD 2,838 ft. Extension and new pay in Linke field.

Calhoun County:
Blanco Oil Co. et al. 4 Lockwood, Andrews & Newman, Miguel Castillo Sur., A-7, 2 miles northwest of Seadrift. AOF 2,700 M.c.f.d., GLR 33.3 M.c.f. per bbl., 57.2°, shut-in pressure 2,186 psi., perf. 7,606½-16½ ft., Frio. TD 7,910 ft. New pay in North San Antonio Bay field.

Lavaca County:
Shell Oil Co. 1 William Borchers, Caroline Brown Sur., A-81, 5½ miles northwest of Morales. AOF 3,800 M.c.f.d., GLR 41.3 M.c.f. per bbl., 52.6°, shut-in TP 5,100 psi., perf. 9,984-10,028 ft., Wilcox, and 62 M.M.c.f.d., GLR 22.5 M.c.f. per bbl., 60°, shut-in TP 4,203 psi., perf. 9,510-44 ft., Wilcox. TD 11,614 ft. New-field discovery.

Matagorda County:
Cyprus Oil Co. 1 R. M. Cole, Bowman & Williams Sur., A-9, 3 miles north of Bay City. AOF 14 M.M.c.f.d., GLR 34.4 M.c.f. per bbl., 53.8°, shut-in TP 3,675 psi., perf. 10,364-84 ft., Frio. TD 10,897 ft. Discovery well of Le Tulle field.

Victoria County:
George H. Coates 1 Murphy, Carolos & Rafael de la Garza Sur., A-46, 13 miles south of Victoria. IP 1,600 M.c.f.d., 12/64-in., TP 2-100 psi., perf. 5,641-49 ft., lower Frio. TD 6,100 ft. New-field discovery.



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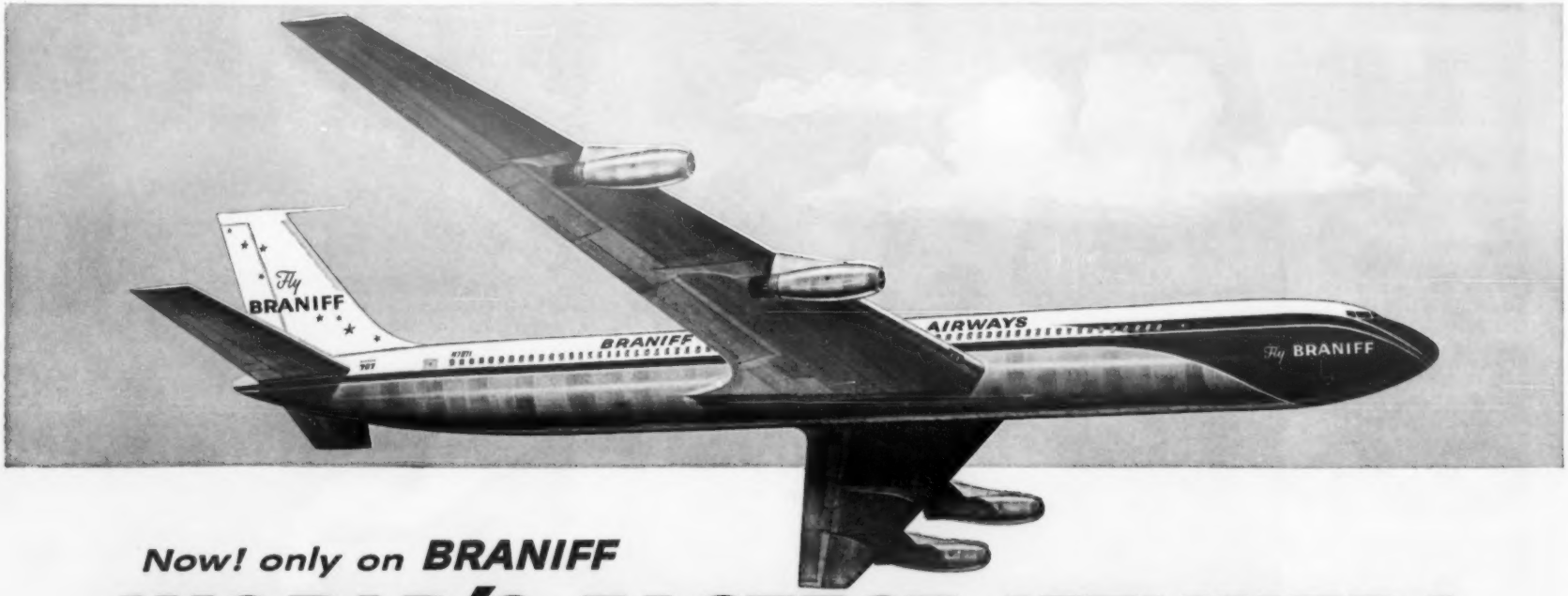

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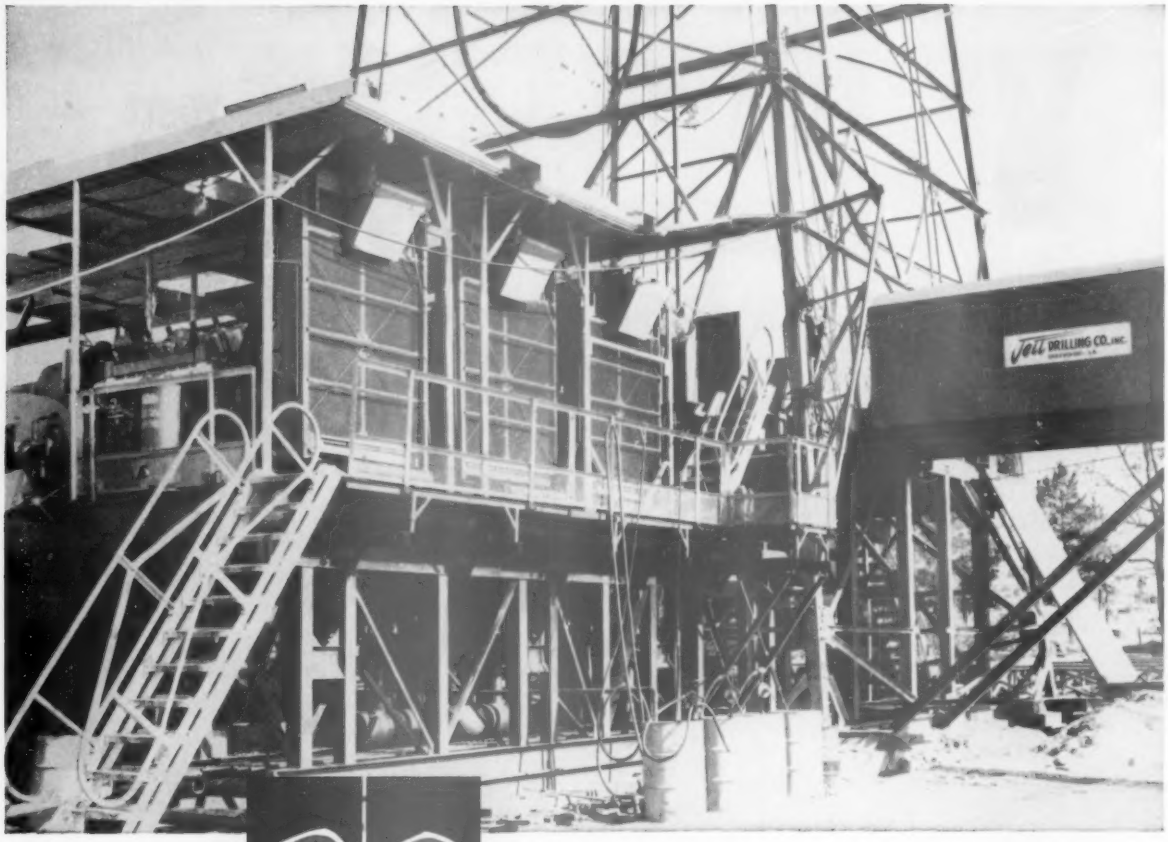

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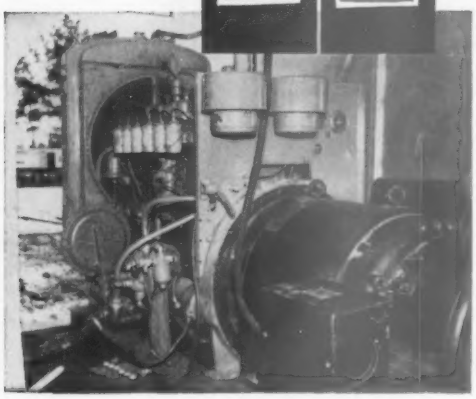
Pictured above is the Jett Rig #114, powered by three Model VLROBU Waukesha Power Units, operating on natural gas. Inset shows a Waukesha "Long Life" Model 145-GZB gas unit, powering a 50 KW generating set, to supply electric power for the rig.



On nine other drilling rigs, Mr. Jett is using ten LRDBC (Diesel); six LRZB (gas); two LRORB (gas); and one NKDBSU (Diesel). With the skid arrangement and the same crankshaft center line heights on the LRDBC, LRZB, and LROR models, the Jett crews can easily change over from gas to Diesel operation in a few hours.

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Union's Kantzer Fits the Bill

. . . to head up the company's exploration operations in U. S. and Canada. He's served in most producing areas.

WHEN Union Oil Co. of California searched its ranks for a man to head up its domestic exploration activities, one of the top requirements was that he have as much experience as possible in all of Union's operating areas in the U. S.

Obviously no one could touch all of Union's bases in a lifetime with anything resembling a well-rounded experience in each area. But the company hit a three-bagger in the selection of Basil Kantzer for the post of vice president in charge of exploration (domestic).

Kantzer last week took office as a vice president of the American Institute of Mining, Metallurgical and Petroleum Engineers at the AIME's annual meeting in New York (see related story on p. 80).

Kantzer has seen service in a management capacity in most of Union's main producing areas, including:

. . . **California Coastal.** He put in a stint as production foreman at Santa Maria (1941).

. . . **San Joaquin Valley.** He was division production foreman at Bakersfield (1943).

. . . **Los Angeles Basin.** Kantzer served in both the Santa Fe Springs and Dominguez fields early in his oil career with Union.

. . . **Gulf Coast.** He was vice president and manager of Union's Gulf Coast division from 1955 to 1959.

Through the years, Kantzer has been active in industry associations and groups. In addition to his present post with the AIME, he has served as president of the Society of Petroleum Engineers of AIME and chairman and councilman of the Pacific Coast chapter of SPE.

Basil Kantzer
. . . Union exploration chief.

He also has been chairman of the engineering board of the conservation committee of California Oil Producers, chairman of the Pacific Coast district of API, and director of Kettleman North Dome Association and Mid-Continent Oil and Gas Association.

Although now back in California after 4 years on the Gulf Coast, Kantzer maintains some strong ties in Texas. He is a member of the executive advisory board of the University of Texas and is a Rice Institute Associate. He is also a director of the Bank of the Southwest in Houston. His son, Mike, is attending Rice Institute in Houston.

Early start . . . Kantzer made his mark in the oil business early in his career by helping develop some of the early advances in subsurface well pressure recording and analysis techniques.

His partner in those early ventures also went on to better things. He's Howard Pyle, president of Monterey Oil Co.

In addition to the jobs and areas listed, Kantzer served with Union as chief production engineer (1943), manager of operations in California (1948), and in 1950 he organized the natural gas and gasoline department of Union.

In his latest assignment, he'll be responsible for Union's exploration activities in the United States and Canada.

Like most Californians, he wasn't born there. He was born in Salt Lake City in 1912. The family moved to San Francisco where Kantzer completed his grade and high-school education and went on to Stanford University. He graduated from college in 1934 with a petroleum engineering degree and went right to work for Union at Santa Fe Springs as a roustabout.

An Eagle Scout in his youth, Kantzer presently is serving on the Los Angeles Area Council Board of Directors of the Boy Scouts. He's also a member of the River Oaks Country Club and the Houston Club in Houston and the Los Angeles Petroleum Club.

An avid golfer, he spent a recent vacation touring golf courses along the East Coast. In the short span of 3 weeks he and his wife played eight different courses along the East Coast.

He originally planned a career as a cartoonist and achieved a measure of success. His cartoons were published in a number of publications, including The Oil and Gas Journal.

▶▶▶ Personals

George A. Peterkin, chairman of Houston Contracting Co., has been elected a director of Falcon Seaboard Drilling Co.

J. L. Minner, Shell Oil Co., has been elected chairman of the board of National Fueloil Council. **William F. Kenny, Jr.,** Meenan Oil Co., has been named vice chairman. New board members of the council include **Robert L. Berry,** Delhi-Taylor Oil Corp.; **A. V. Fraser,** Standard Oil Co. (Ind.); **V. L. Verdiani,** Sun Oil Co.; **D. E. Hoffman,** Tidewater Oil Co.; **C. R. Romer,** Sinclair Refining Co.; and **Perry A. Peterson,** Cities Service Petroleum, Inc.

Claude C. Griffin, assistant production foreman in Ardmore, Okla., for Samedan Oil Corp., has been promoted to production foreman and transferred to Hobbs, N. M.

A. M. McLachlin, Regina division production superintendent for Shell Oil Co. of Canada, has been named production manager for the division. He succeeds **B. V. Barker,** who has been transferred to Calgary as special assistant to the production manager.

H. K. Coale, Jr. formerly production foreman with Ada Oil Co. in Wichita Falls, Tex., has joined McCommons Oil Co. as production superintendent in Bridgeport, Tex.

Ralph Simon has been appointed group supervisor, solvent drive processes, in the oil recovery division of California Research Corp.'s La Habra, Calif., laboratory. **P. I. Brown** has been named group supervisor in the engine lubricants division at the company's Richmond, Calif., laboratory. **V. M. Hance** has joined Cal Research in Richmond as research engineer, engine lubricants division.

Personals

V. C. Scott, assistant to general manager in the domestic producing department of Texaco Inc., has been promoted to chief geologist. Scott has been district geologist in Mattoon, Ill., Tulsa division geologist, and assistant Tulsa division manager for Texaco. He had been assistant to general manager since 1958.

Daniel E. Boone, petroleum engineer with Amerada Petroleum Corp. in Tioga, N. D., has been promoted to district petroleum engineer and transferred to Williston, N. D.

Dudley P. Penick, formerly senior process engineer in Dallas for Magnolia Petroleum Co., has been appointed staff gas engineer for Mobil International Oil Co. in New York. Penick recently has been on loan assignment with Mobil Oil Co. de Venezuela.

A. F. Woodward, Union Oil Co.'s chief exploitation engineer for the Pacific Coast division, has been appointed manager of field and exploration operations, Pacific Coast division. **C. F. Bowden,** chief petroleum engineer, Pacific Coast division, has been named assistant to the vice president in charge of production. Woodward has been with Union since 1946 and had been chief exploitation engineer, Pacific Coast, since 1957.

WOODWARD

T. A. Aldridge, vice president, marketing, for American Oil Co. in New York, has been named director of marketing development for Societe Civile Amoco in Paris. **C. H. Coughlin,** general manager of sales for American Oil, will succeed Coughlin as marketing vice president. The appointments are effective April 1.

Walter L. Hurt, Sohio Petroleum Co., has been elected president of the Southwest Louisiana Geophysical Society. Other new officers include **Dick Hollenbaugh,** Petty Geophysical Engineering Co., vice president; **Lucius Geer,** Union Oil Co. of California, secretary; and **R. Ned Pratt,** Sun Oil Co., treasurer.

Clarence F. Simes, formerly staff engineer for Service Pipe Line Co. in Lubbock, Tex., has been appointed superintendent of the company's Lovington, N. M., district.

Patterson Lay, formerly district production superintendent in Casper, Wyo., for Tennessee Gas Transmission Co., and **Clovis Rodelander,** formerly district petroleum engineer for TGT in Casper, have formed Rodelander & Lay, petroleum consulting firm, in Casper.

Irving E. Chapman, formerly executive assistant to the president of Tidewater Oil Co., has been named assistant general manager of the company's eastern division. Chapman is a former vice president of Mitsubishi Oil Co., Tidewater subsidiary in Japan.

Shell Oil Co. will combine its Kansas exploration division with the Oklahoma division in Oklahoma City. **K. A. (Ken) Keenmon,** division geologist in Wichita, will be transferred to Oklahoma City, where he will be responsible for coordination and planning in the combined Oklahoma-Kansas division. No changes are expected in Shell's Wichita land department or scouting section.

Lt. Gen. Manuel J. Asensio, U.S. A.F. (ret.), has joined Texas Butadiene & Chemical International, Ltd., as chief executive officer of the Argentine company which Texas Butadiene is organizing. He will headquarter in Buenos Aires. Texas Butadiene plans to build a petrochemical complex near Puerto Deseado, Argentina.

Dr. W. C. Howells, Texaco Canada, Ltd., has been elected 1960 chairman of Canadian Petroleum Association's Alberta division board of directors. He succeeds **J. B. Webb,** Alimex, Ltd. **A. F. Beck,** Canadian Export Gas & Oil Ltd., has been elected first vice chairman, and **J. G. Spratt,** Triad Oil Co., Ltd., has been named second vice chairman. New directors of the Alberta division include Beck; **A. G. Bailey,** Bailey Selburn Oil & Gas, Ltd.; **R. W. Campbell,** Home Oil Co., Ltd.; **Alexander Clark,** Calgary & Edmondton Corp., Ltd.; **A. O. Detmar,** Mobil Oil of Canada, Ltd.; **G. E. Dunlap,** Sun Oil Co.; **E. J. Gallagher,** British American Oil Co., Ltd.; **P. L. Kartzke,** Shell Oil Co. of Canada, Ltd.; **G. L. Knox,** California Standard Co.; **W. M. Luthy,** Canadian Oil Companies, Ltd.; **W. D. C. Mackenzie,** Imperial Oil Ltd.; **C. O. Nickle,** Conick Petroleums, Ltd.; and **G. T. Pearson,** Hudson's Bay Oil & Gas Co., Ltd.

Carstens Slack, manager of Phillips Petroleum Co.'s public relations division in Bartlesville, Okla., has been named manager of the company's Washington office. He succeeds the late E. D. McElvain.

Robert L. Whiting, head of the department of petroleum engineering at Texas A&M College, has been named acting director of the Texas Petroleum Research Committee. He succeeds **Dr. George Fancher,** who recently resigned to become vice president for production research with Sinclair Research Laboratories.

Paul L. Henderson, vice president and a director of Ohio Oil Co., has been named vice president in charge of international production in a realignment of Ohio's production organization. **Glenn F. Bish,** vice president and a director, is in charge of domestic production. Henderson will head Ohio's exploration and production activities outside the U. S. The company has production in Canada, Venezuela, and Libya, and exploration programs in Guatemala, Somalia, Tunisia, and Australia. Henderson joined Ohio in 1929 in Los Angeles. He has been a vice president since 1955. Bish joined the company in 1924 and was named vice president and a director last year.

HENDERSON

BISH

T. E. (Jack) Hobbs, formerly exploration manager in Salt Lake City for Mobil Oil Co., has been transferred to Durango, Colo., as district exploration manager of Mobil's new Rocky Mountain district exploration office. **John P. Lockridge,** formerly geologist in Durango, has been named district geologist. **L. N. Kay,** formerly land man in Albuquerque, has been appointed district land man. **H. E. Blackburn,** Durango seismologist, will be district seismologist. Moving from Salt Lake City to Durango are geologists **R. R. Smart, George Witter, R. O. Linscott,** and **Dale Holyoak,** and land man, **Dick Cramer. D. E. Barrett, Charles Cline,** and **George Guynes,** geologists, have been transferred to Durango from Rock Springs, Mont. **H. L. Dunn,** geologist, has been transferred from Sacramento, Calif.

B-A Honors Suhr for Long Service

SILVER TRAY given to Charles L. Suhr, left, recognizes his 50 years of service as a director of British American Oil Co., Ltd. Edward D. Loughney, right, B-A president, is shown making the presentation. Suhr, chairman of South Penn Oil Co., joined B-A as a director in 1909, 3 years after the company was founded.

Tom Lindholm, formerly with The California Co., has joined Photogravity Co., Inc., as executive vice president. Lindholm was with Standard Oil Co. of Texas before joining Calco last year.

H. L. Knapp, assistant manager of Ohio Oil Co.'s Robinson, Ill., marketing district, has been promoted to district manager. He succeeds **J. P. Hughes,** who will retire March 1. **D. M. Groom,** zone manager in Muncie, Ind., will succeed Knapp.

Orlo E. Childs, Phillips Petroleum Co., Denver, has been installed as 1960 president of the Rocky Mountain section, American Association of Petroleum Geologists. Other officers include **Graham S. Campbell,** Salt Lake City consultant, vice president; and **Floyd H. Miller,** British-American Oil Producing Co., Denver, secretary-treasurer.

R. F. Zimmerly has been named chief geophysicist for Texaco Exploration Co., succeeding **F. B. Wallis,** who has been transferred to Texaco Inc. in Houston. **R. R. Baker** has been named Texaco Exploration chief geologist. **W. H. Slater** has been named pipeline superintendent for the company. He succeeds **Glynne J. Evans,** who recently was named vice president of Trans-Northern Pipe Line Co.

D. L. Schmidt, production engineer for Richfield Oil Corp. in Bakersfield, Calif., has been transferred to Long Beach, Calif., as development engineer.

John A. Meintjes, formerly agent for Phillips Petroleum Co., in South African operations, has joined the company in New York as a technical sales engineer in the sales and development division, international department.

Wilburn T. Askew, formerly president of Sun Oil Co., Ltd., has been elected vice president in charge of refineries for Sun Oil Co. He has also been named a director of the parent company, succeeding **Frank R. Markley,** who has resigned as a director and will retire in April as vice president in charge of transportation. Askew will act as liaison officer between Sun and its Canadian subsidiary.

▶▶▶ Personals

Robert K. Brooke, formerly with Asiatic Petroleum Corp., has joined Independent Refiners Association of America as assistant to the president. He will headquarter in Washington.

Francis C. Savage, formerly assistant manager of Mobil International Oil Co.'s manufacturing department, has been named manager of the distribution planning department. **Edward C. Ball,** aviation sales manager for Mobil Oil Hellas in Athens, has been appointed assistant to the manager of Mobil International's aviation sales department.

Robert H. Park, chief gas engineer in the Houston domestic producing department office of Texaco Inc., has been promoted to assistant gas division manager. **Erwin A. Gromatsky,** assistant superintendent of gas and gasoline plants in the New Orleans division, will succeed Park. They will headquarter in Houston.

W. L. Horner, vice president and engineering chief for Core Laboratories, Inc., Dallas, has resigned to join **George H. Jett,** Shreveport, La., independent, in a management - interest capacity. Jett is a major producer in Alabama's big Citronelle field where a large-scale unitized secondary-recovery project is believed near realization. Horner had been associated with the project since 1955 through an engineering contract between Core Lab and Citronelle operators. He had been with Core Lab since 1954 after 11 years with Sunray Mid-Continent Oil Co. Horner will headquarter in Mobile, Ala. He will continue his association with Core Lab as a special consultant on projects involving certain patented core-analysis techniques, equipment, and recovery processes.

HORNER

(Personals continued on page 178)

▶▶▶ Deaths

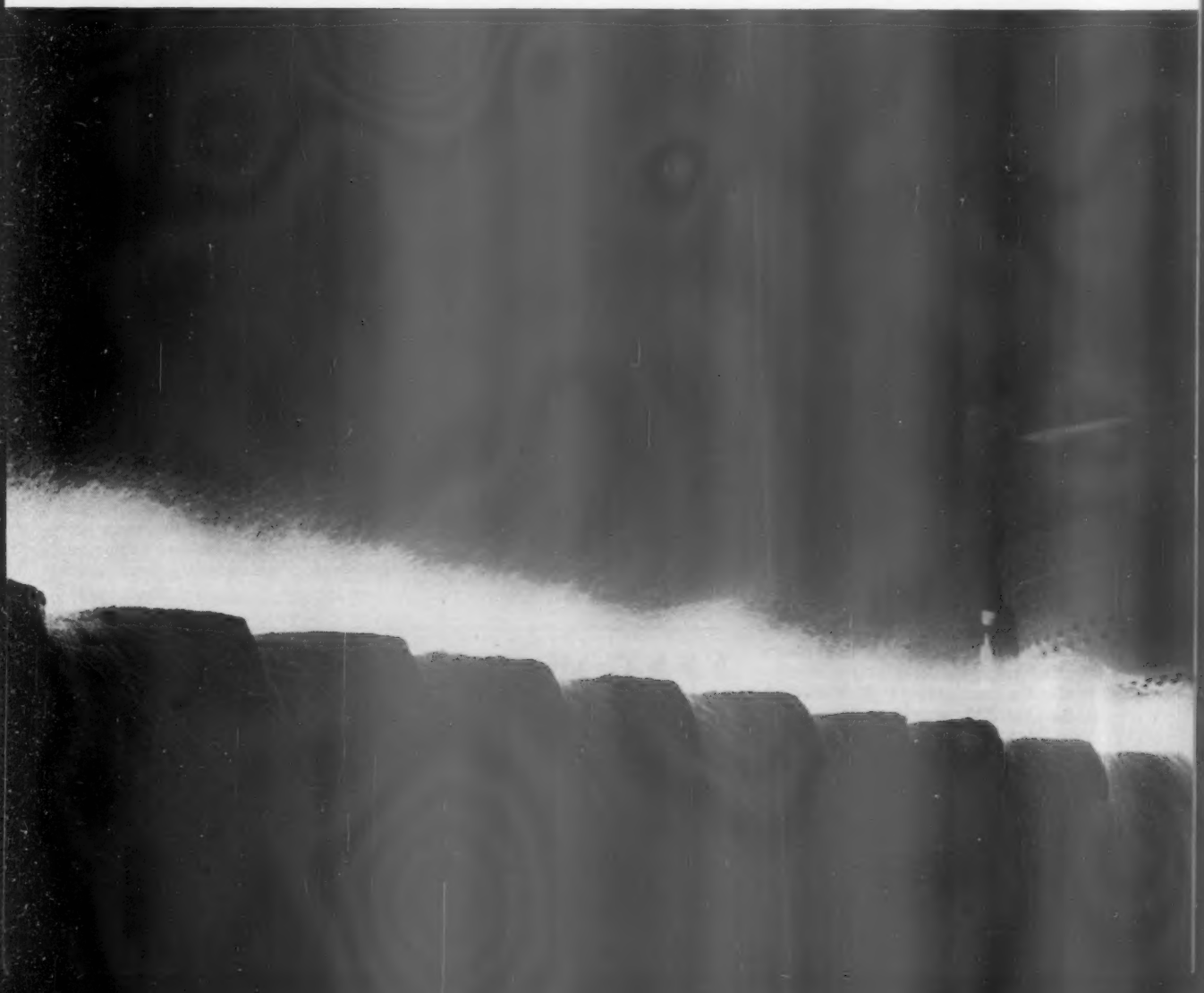
Herman F. Heep, 60, Austin, Tex., independent, died February 10. Heep was owner of Heep Oil Corp., Austin, until its sale last summer.

Leo Vernon Uhrig, 56, research engineer with Humble Oil & Refining Co., died February 13 at his Houston home after a heart attack. Uhrig had been with Humble since 1936. He was an engineering instructor at Rice Institute before that time.

Howard G. Farnsworth, 69, Tulsa independent operator, died February 12 in a Tulsa hospital.

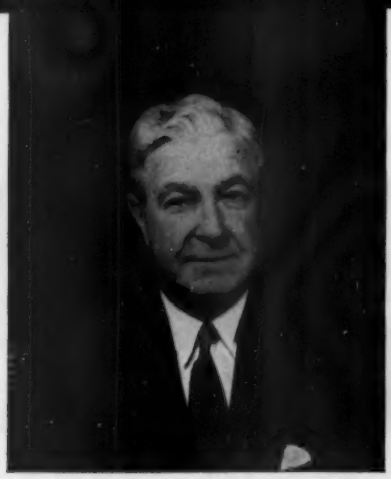
Republic Reports on OPERATION 375

With a huge increase in capacity just completed, Republic is making another major move . . . spending 375 million dollars *more* for improvement and replacement of present facilities and addition of certain new facilities. Already allocated funds will be spent over the next three to four years. Here is how you will benefit.



"The new $375,000,000 capital expenditure marks our intense emphasis on customer service. In the decade ahead, customers' needs will change even more dramatically than in the past few years. *We will anticipate* those needs."

Charles M. White, *Chairman*



"We will be concentrating on changes, replacements, and additions which will raise efficiency. Raise efficiency and you improve product quality. Improve quality and you *serve customers better.*"

Thomas F. Patton, *President*

"Customers continue to increase the efficiency of their plants with more modern and more costly equipment. OPERATION 375 will enable us to provide the finishes, sizes, and other specifications required by this new equipment."

Norman W. Foy
Vice President in Charge of Sales

"Customers will exercise their right to be more demanding. We are building now to meet specifications which are advanced today but which, we are convinced, will become usual among our customers in 5 or 6 years."

Ernest R. Johnson
Vice President in Charge of Operations

REPUBLIC STEEL

World's Widest Range
of Standard Steels and Steel Products

▶▶▶ Personals

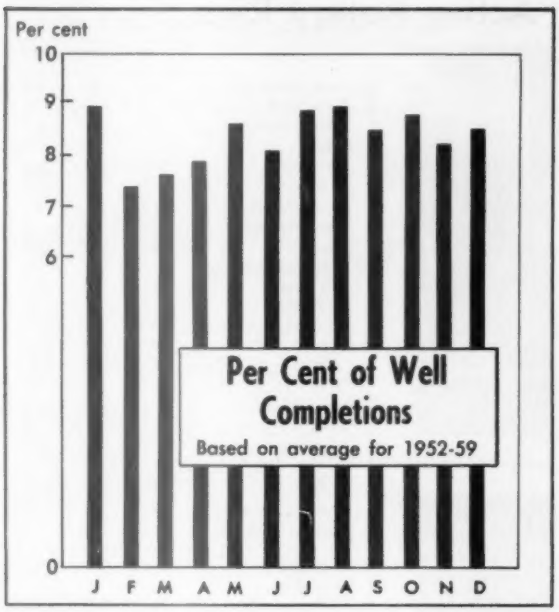
TULSA: First row, left to right: Oscar B. Irizarry, senior regent; T. D. Williamson, Jr., deputy sergeant-at-arms; John Pearce, third-year regent; Paul V. McGivern, president; Harry S. Horton, secretary; R. R. Matthews, assistant treasurer; Larry Harper, sergeant-at-arms; T. M. Lumly, junior regent. Second row, left to right: Floyd C. Cummings, assistant secretary; W. O. Timberlake, vice president; E. M. Donovan, treasurer.

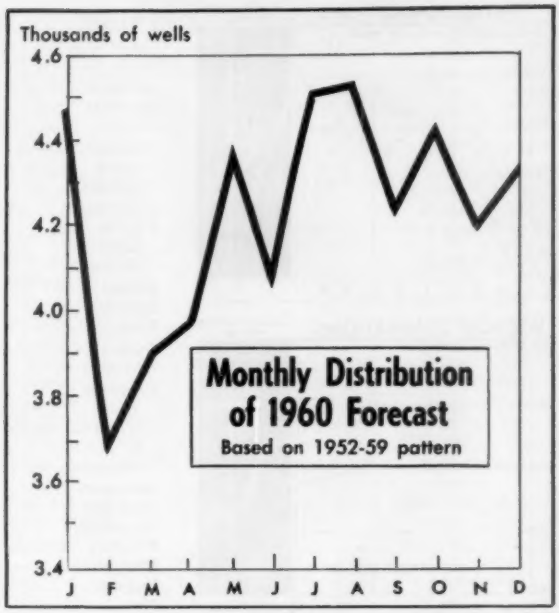
Nomads Elect Officers

DALLAS-FORT WORTH: First row: Charles E. Trapp, vice president, regional; Robert H. McLemore, executive vice president; Harry S. Zane, Jr., president; William C. Brooks, vice president, Fort Worth; K. Marshall Fagin, treasurer. Second row: J. A. Kelly, vice president, Dallas; Eric Sutton, deputy sergeant-at-arms; Ramon H. Robinson, sergeant-at-arms. Third row, left to right: R. E. Elmore, Rollo Davidson, and Courtney J. Berlin, regents.

NEW YORK: First row: John D. Evans, secretary; W. E. Volkman, vice president; Hollis W. Haltom, president; D. T. O'Connor, treasurer; R. L. Faris, sergeant-at-arms. Second row: T. E. Ramey, assistant treasurer; Maurice F. Delano, Jr., senior regent; Don E. Kircher, regent; John Davis, assistant secretary; Paul Nagle, assistant sergeant-at-arms; Ed T. Landgraff, assistant sergeant-at-arms. Not pictured are E. D. Carney, assistant sergeant-at-arms; E. E. Andreason, regent.

HOUSTON: First row: E. W. Louden, regent; J. B. Hughes, regent; B. H. Pickard, regent; John W. Gates, president; Bruce Barkis, vice president. Second row: J. W. Wallace, sergeant-at-arms; Kenneth P. Morris, assistant treasurer; Bernard J. Gross, treasurer; Fred Christanelli, secretary; Beau Wendt, deputy sergeant-at-arms; Terry Russell, assistant secretary.





January doesn't make a drilling year

BY JOHN C. CASPER

FOR THE PAST 8 years January has been a better-than-average month for well completions. The first part of the above chart shows that January completions accounted for 8.83% of the total for the 1952-59 period.

However, January's portion of the total has varied widely over the past 8 years. In 1955 January completions accounted for only 7.66% of the total for that year. On the other hand, completions in January 1958 represented 10.16 of the year's total.

In recent years, January completions have shown gains that were out of proportion to total changes for the year. The all-time record for January was in 1957 when scouts reported 5,145 new wells for the month. This total represented a gain of 190 wells over completions in January 1956. But completions for the full year 1957 showed a loss of 4,322 wells from the all-time record of 58,160 reported in 1956.

The trend toward expanded January drilling in recent years tends to distort the drilling picture for January this year.

If completions this year were to follow the 8-year average, the January portion of the 50,769 wells forecast for the year would be 4,483 new holes. Actual completions reported for January amounted to a little over 4,200 wells or about 280 fewer wells than the total based on The Journal's annual forecast and averages for the past 8 years.

Comparison with the total for January 1959 produces an even greater distortion. Operators completed 4,654 wells in January last year, and with this total as a base, completions this year show a loss of more than 450 wells. This comparison with the relatively high figure for January 1959 tends to make the current picture look darker than it really is.

All of this seems to indicate that the total number of completions in the month of January does not make a good bench mark for estimating total drilling for the year.

Reports from a large group of operators showed that drilling plans called for about as many wells as they completed last year.

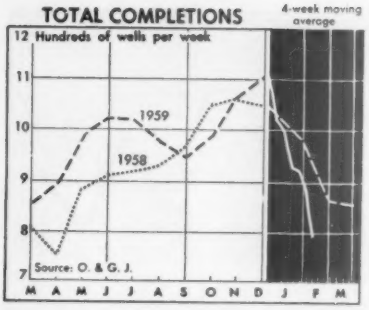
Weather was a little warm in January and distillate demand was not up to par. Product prices softened in most market areas. Crude allowables are still low. Actual income from crude and gas may have been down a little from January 1959. All of these factors influenced both completions and new locations in January.

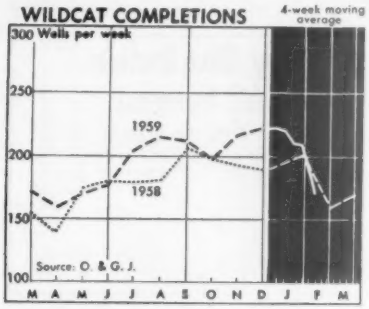
If income from oil and gas returns to its upward trend for the remainder of the year, drilling rates will follow original plans despite the poor showing in January.

A quick look at the highlights . . .

	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	7,278,670	DOWN	50,755	UP	68,900
Crude stocks	249,971,000	UP	1,194,000	DOWN	7,267,000
Completions	739	DOWN	37	DOWN	160
Refinery runs	8,077,000	DOWN	122,000	UP	123,000
Gasoline stocks	208,908,000	UP	2,490,000	UP	8,788,000
Kerosine stocks	23,709,000	DOWN	579,00	UP	3,756,000
Distillate stocks	118,340,000	DOWN	3,181,000	UP	30,085,000
Residual stocks	48,038,000	UP	365,000	DOWN	7,608,000
Four-product stocks	398,995,000	DOWN	905,000	UP	35,021,000
Total imports	1,614,900	DOWN	429,400	DOWN	233,600

DRILLING





Active Rotary Rigs

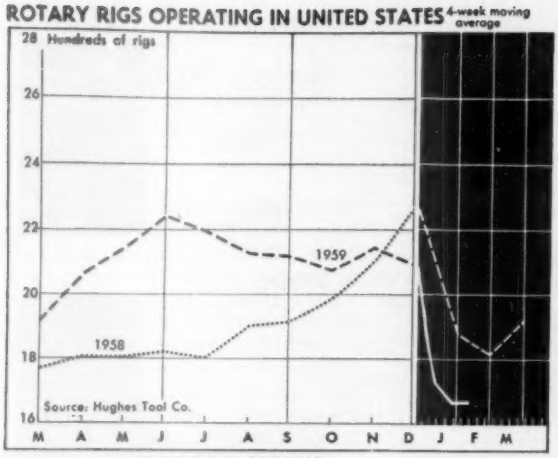
	2-15-60	2-8-60	2-16-59
Alabama	3	4	8
Arkansas	13	11	13
Arizona	0	0	0
California	69	59	77
Land	64	53	74
Offshore	5	6	3
Colorado	26	26	25
Florida	1	1	1
Land	0	0	1
Offshore	1	1	..
Illinois	15	17	15
Indiana	4	5	1
Iowa	1	2	3
Kansas	80	112	134
Kentucky	7	9	3
Louisiana	295	304	304
North	30	34	27
S. Inland waters	120	115	140
S. Land	96	98	98
Offshore	49	57	39
Maryland	0	0	1
Michigan	32	34	17
Mississippi	80	72	57
Missouri	2	1	0
Montana	11	8	20
Nebraska	17	17	18
Nevada	0	0	0
New Mexico	83	89	94
New York	0	0	0
North Dakota	17	22	27
Ohio	3	2	2
Oklahoma	175	185	213
Oregon	0	0	0
Pennsylvania	10	11	11
South Dakota	0	2	1
Texas	589	597	693
S. Inland waters	6	7	8
S. Land	158	162	124
Offshore	0	0	1
North-East	143	141	158
West Central	198	205	263
West	84	82	139
Utah	27	26	33
Washington	1	1	1
West Virginia	3	3	3
Wyoming	54	58	51
Total U. S.	1,618	1,678	1,826
Western Canada	242	235	222
Eastern Canada	4	4	0
Grand total	1,864	1,917	2,048

Hughes Tool Co. report.

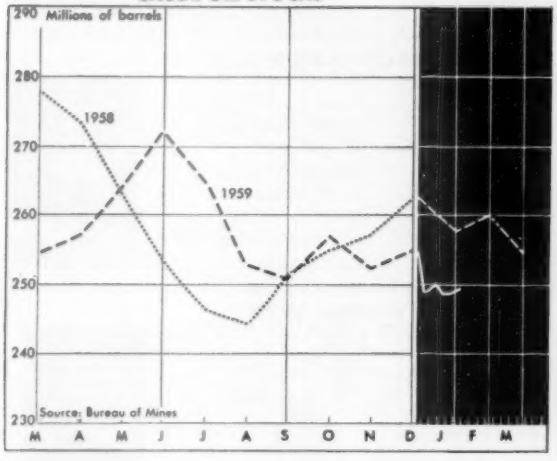
WEEKLY WELL COMPLETIONS . . . WEEK ENDED FEBRUARY 13, 1960

	Total wells							Cum.		Total wildcats					Cum.	
	Total	Crude	Cond.	Gas	Dry	Service	Footage	1960	1959	Total	Crude	Cond.	Gas	Dry	1960	1959
Alabama	0	0	0	0	0	0	0	8	19	0	0	0	0	0	1	3
Arizona	0	0	0	0	0	0	0	6	.....	0	0	0	0	0	6	.....
Arkansas	11	6	0	1	4	0	42,813	72	130	3	0	0	0	3	19	26
California	20	14	0	0	4	2	76,976	175	217	1	0	0	0	1	37	56
Colorado	9	3	0	2	4	0	38,278	92	94	4	0	0	0	4	47	47
Illinois	49	16	0	0	14	19	74,740	308	325	6	0	0	0	6	73	52
Indiana	12	5	0	0	7	0	15,489	121	89	5	0	0	0	5	41	27
Kansas	67	38	0	4	23	2	249,096	446	553	21	8	0	1	12	144	130
Kentucky	42	15	0	10	17	0	68,961	295	202	9	0	0	0	9	35	16
Louisiana	63	28	2	7	26	0	509,127	442	466	9	0	0	2	7	58	72
North	17	4	0	4	9	0	90,405	152	168	6	0	0	2	4	27	37
South	34	18	1	1	14	0	286,553	220	250	2	0	0	0	2	28	34
Offshore	12	6	1	2	3	0	132,169	70	48	1	0	0	0	1	3	1
Michigan	19	8	0	0	11	0	70,406	89	70	5	0	0	0	5	34	20
Mississippi	12	5	1	0	6	0	122,495	92	92	5	1	0	0	4	35	46
Montana	4	0	0	0	4	0	6,491	40	37	3	0	0	0	3	22	12
Nebraska	16	3	0	0	13	0	90,894	94	82	8	1	0	0	7	36	36
New Mexico	38	23	3	2	10	0	202,519	264	232	2	0	0	0	2	35	23
West	10	3	2	2	3	0	53,286	92	.....	1	0	0	0	1	7	.....
East	28	20	1	0	7	0	149,233	172	.....	1	0	0	0	1	28	.....
New York	0	0	0	0	0	0	0	50	52	0	0	0	0	0	5	1
North Dakota	4	3	0	0	1	0	27,788	38	57	1	0	0	0	1	7	12
Ohio	25	9	0	6	10	0	67,273	166	110	1	0	0	0	1	9	4
Oklahoma	74	37	1	5	27	4	343,401	495	697	16	5	0	1	10	100	123
Pennsylvania	0	0	0	0	0	0	0	0	59	0	0	0	0	0	2	1
South Dakota	0	0	0	0	0	0	0	4	.....	0	0	0	0	0	2	.....
Texas	227	117	5	7	98	0	889,188	2,123	2,515	64	2	0	0	62	460	488
Dist. 1	30	10	0	1	19	0	69,408	164	187	16	0	0	0	16	64	45
Dist. 2	10	1	1	2	6	0	66,744	90	105	4	0	0	0	4	24	23
Dist. 3	15	9	1	0	5	0	103,392	180	153	3	0	0	0	3	35	50
Dist. 4	12	0	1	1	10	0	80,122	186	185	8	0	0	0	8	55	55
East	15	11	1	0	3	0	60,588	177	150	2	0	0	0	2	38	37
Dist. 7-B	39	16	0	2	21	0	122,784	273	311	12	0	0	0	12	80	94
West	46	31	0	0	15	0	228,120	584	791	15	2	0	0	13	98	85
Dist. 9	49	29	1	0	19	0	117,726	359	445	4	0	0	0	4	59	72
Dist. 10	11	10	0	1	0	0	40,304	110	188	0	0	0	0	0	7	17
Utah	4	3	0	1	0	0	23,480	35	45	0	0	0	0	0	13	12
West Virginia	30	2	0	26	2	0	78,817	92	97	0	0	0	0	0	1	3
Wyoming	12	6	0	2	3	1	66,459	119	110	3	2	0	1	0	50	47
Misc. (Wash.)	1	0	0	0	1	0	8,520	4	11	1	0	0	0	1	3	8
Total U. S.	739	341	12	73	285	28	3,073,211	5,670	6,361	167	19	0	5	143	1,275	1,265
Previous week	776	369	18	83	284	22	3,204,940	.....	.....	156	18	1	8	129	.....	.....
Cum. 1960	5,670	2,670	191	482	2,165	162	24,658,220	.....	.....	1,275	116	13	39	1,107	.....	.....
Cum. 1959	6,361	3,166	169	445	2,408	173	26,946,141	.....	.....	1,265	121	18	45	1,081	.....	.....
Western Canada	45	25	0	6	14	0	243,688	252	263	14	1	0	3	10	71	88

ROTARY RIGS OPERATING IN UNITED STATES



CRUDE-OIL STOCKS



CRUDE-OIL STOCKS BY STATES OF ORIGIN*

(Thousands of barrels)

	2-6-60	1-30-60	2-7-59
Pennsylvania	2,317	2,250	2,561
Other Appalachian	2,062	1,956	1,418
Illinois, Indiana, Michigan	9,540	9,603	9,535
Nebraska and North Dakota	2,602	2,801	2,204
Kansas	9,910	9,131	9,343
Oklahoma	16,798	16,789	16,085
Arkansas	2,222	2,183	2,135
Louisiana	18,915	18,831	17,187
North	2,853	3,226	3,037
South	16,062	15,605	14,150
Mississippi, Alabama, Florida	2,296	2,487	2,381
New Mexico	7,446	7,392	8,877
Texas	105,489	106,501	114,938
East Texas	7,869	7,964	8,898
West Texas	48,637	50,068	56,335
Texas Gulf	19,150	19,026	19,513
Other Texas	29,833	29,443	30,192
Wyoming	17,396	17,365	13,049
Other Rocky Mountain	9,395	9,128	9,176
California	28,643	28,246	33,616
Foreign	†14,940	14,114	14,733
Total	**249,971**	248,777	257,238

*Bureau of Mines. †Includes 4,694,000 bbl. in California.

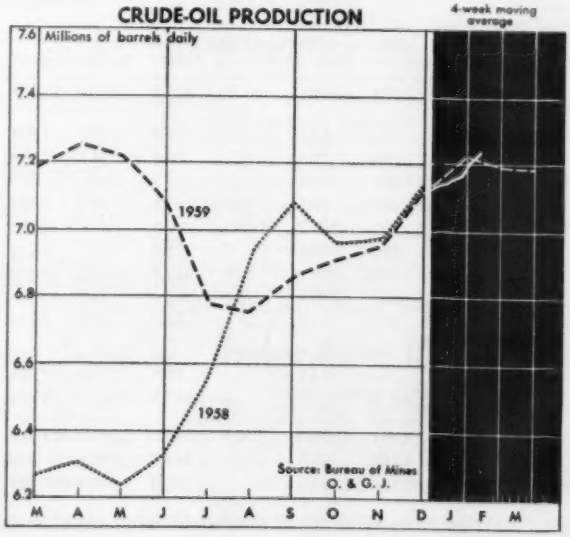
DAILY AVERAGE PRODUCTION FOR WEEK

	February 13, 1960			Feb. 6
	Crude oil	Lease condensate	Total	total
Alabama	19,175	.....	19,175	19,150
Arkansas	78,725	300	79,025	80,050
California	832,000	.....	832,000	830,900
Colorado	128,800	.....	128,800	129,500
Eastern	42,900	.....	42,900	40,100
Florida	1,150	.....	1,150	1,175
Illinois	208,100	.....	208,100	219,900
Indiana	33,000	.....	33,000	32,600
Kansas	†298,870	.....	†298,870	†328,550
Kentucky	67,600	.....	67,600	67,400
Louisiana	956,000	132,500	1,088,500	1,086,375
North	108,000	6,000	114,000	114,150
South	848,000	126,500	974,500	972,225
Michigan	28,300	.....	28,300	35,100
Mississippi	140,200	5,025	145,225	146,175
Montana	79,300	.....	79,300	80,500
Nebraska	62,900	.....	62,900	63,400
Nevada	100	.....	100	100
New Mexico	297,900	6,700	304,600	303,075
North Dakota	56,800	.....	56,800	59,700
Oklahoma	†543,500	.....	†543,500	†581,800
Texas	2,706,000	90,225	2,796,225	2,761,375
Dist. 1	41,000	3,800	44,800	44,525
Dist. 2	119,000	9,200	128,200	126,200
Dist. 3	355,000	38,500	393,500	389,225
Dist. 4	190,000	15,800	205,800	202,650
Dist. 5	27,000	500	27,500	27,500
Dist. 6	119,000	9,400	128,400	145,575
East Texas field	147,000	.....	147,000	126,125
Dist. 7-B	139,000	200	139,200	138,050
Dist. 7-C	130,000	3,625	133,625	131,625
Dist. 8	1,139,000	5,600	1,144,600	1,126,025
Dist. 9	192,000	2,200	194,200	194,475
Dist. 10	108,000	1,400	109,400	109,400
Utah	109,400	.....	109,400	110,600
Wyoming	352,000	.....	352,000	350,900
Others	‡1,200	.....	‡1,200	‡1,000
Total U. S.	7,043,920	234,750	**7,278,670**	7,329,425
Change from prev. week, down			**50,755**	.....
Canada	†542,500	.....	†542,500	†620,300

Total U. S. production—Jan. 1-Feb. 13 ..... 317,162,900 bbl.
Same period last year (crude plus cond.) ..... *317,338,700 bbl.

*Includes 8,746,800 bbl. condensate. †Week ended previous Monday. ‡Alaska and South Dakota.

CRUDE-OIL PRODUCTION



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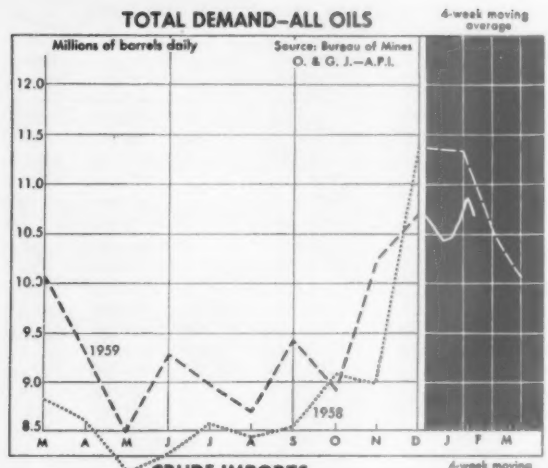

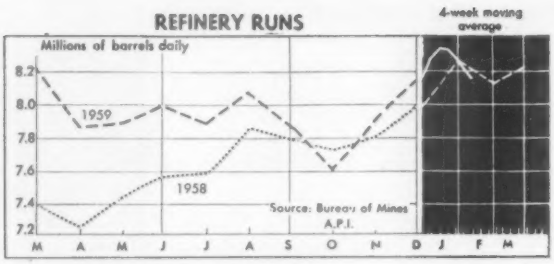

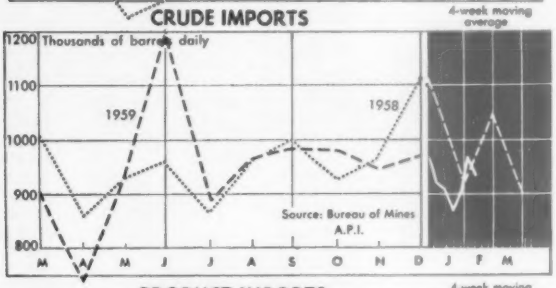

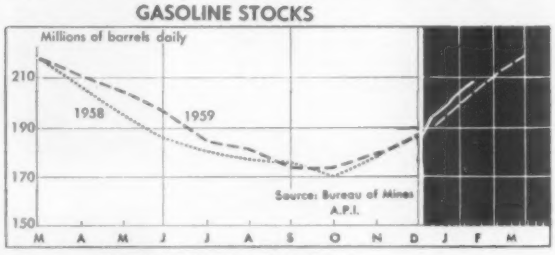

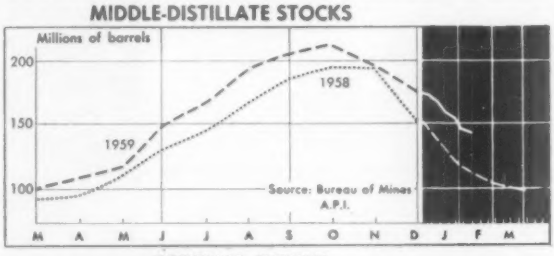

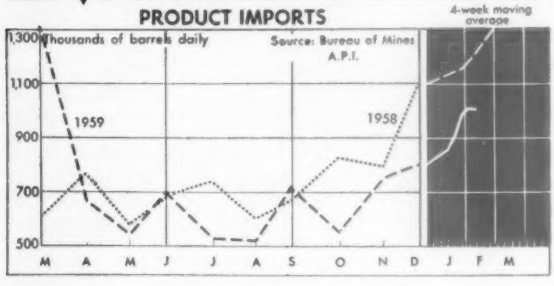

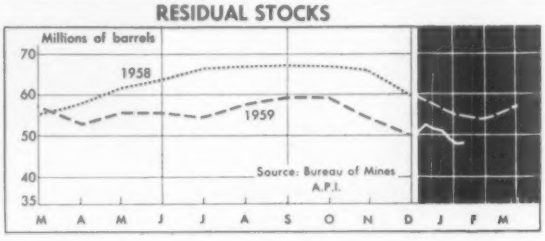

API REFINERY REPORT—FEBRUARY 12, 1960

(Thousands of barrels)

District—	Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.	Stocks‡ Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, February 1959 Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.
East Coast	1,093	505.6	41.1	317.3	173.3	42,338	10,030	43,418	12,952	1,223	562.0	50.8	437.5	217.9
Appalachian:														
District 1	101	42.1	3.9	20.9	15.9	5,731	586	3,099	316	101	41.2	6.6	24.1	13.0
District 2	106	56.4	7.3	18.4	14.3	2,996	433	1,312	367	115	55.9	9.9	21.9	17.1
Ind., Ill., Ky.	1,488	756.9	67.7	314.3	208.4	38,717	4,543	20,271	4,986	1,505	714.3	81.3	381.6	234.0
Minn., Wis., Dak.	124	62.3	5.3	27.6	17.3	7,164	887	5,405	647	104	52.1	5.8	26.1	12.9
Okla., Kans., Mo.	733	415.0	20.3	181.1	27.9	20,892	1,019	9,749	1,017	778	419.4	16.9	225.5	38.8
Inland Texas	290	198.4	11.3	51.4	20.1	8,212	415	1,321	2,432	290	196.2	8.9	51.0	22.3
Texas Gulf Coast	1,946	988.9	126.7	442.6	180.0	27,460	2,383	12,771	5,349	1,775	807.9	139.4	517.1	183.3
La. Gulf Coast	631	286.1	52.8	102.3	51.1	11,766	1,832	4,386	1,150	716	351.5	78.4	189.3	52.5
N. La. and Ark.	106	43.0	10.0	22.0	5.0	5,826	837	2,394	191	106	51.1	6.9	24.0	6.4
Rocky Mountain:														
New Mexico	27	15.3	0.7	5.0	3.3	902	61	167	125	25	12.4	0.7	4.4	2.5
Other Rky. Mt.	296	144.1	4.0	70.7	34.4	7,270	196	2,301	1,100	293	136.9	4.6	61.5	38.4
West Coast	1,136	523.9	3.6	192.5	274.4	29,634	487	11,746	17,406	1,096	538.1	7.2	195.1	285.7
Feb. 12, 1960	8,077	4,038.0	354.7	1,766.1	1,025.4	208,908	23,709	118,340	48,038	8,127	3,939.0	417.4	2,159.1	1,124.8
Feb. 5, 1960	8,199	4,150.0	338.3	1,956.6	1,090.6	206,418	24,288	121,521	47,673	.....	.....	.....	.....	.....
Feb. 13, 1959	7,954	3,823.1	421.7	2,202.9	1,050.6	200,120	19,953	88,255	55,646	.....	.....	.....	.....	.....

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines.

The No. 2 price on the Gulf Coast is off to 8 cents

DISTILLATE-FUEL markets are under pressure from all sides. First, both suppliers and distributors try to sell surplus distillate by the first of March. Second, mild winter weather in most of the high-demand areas has held distillate demand well below the level set as normal by most suppliers. Third, refiners have made too much distillate this winter. The resulting distillate surplus in refiners' tanks has caused a sharp drop in distillate prices over the past 2 weeks.

Refinery runs averaged 8,225,000 bbl. daily for the first 6 weeks this year compared with 8,130,000 bbl. daily for the same period last year. Both averages are from API weekly data.

Total distillate demand averaged 3,113,000 bbl. daily in January 1959, but current data indicate a drop to 2,830,000 bbl. daily in January this year. This drop in demand of almost 300,000 bbl. daily is showing up as high inventories.

The distillate-stock total was reported at 118,340,000 bbl. on February 12 for an increase of 30,000,000 bbl. over last year and 10,000,000 bbl. over the level reported in 1958. And, distillate stocks at the end of January 1958 set a new record for that date.

Climbing distillate stocks have created several bad storage problems on the Gulf and East Coasts.

Near the end of January, a Gulf Coast refiner ran short on clean storage. Since the peak of the heating season was past, most refiners would decide against starting the summer season with tanks full of distillate. The refiner moved several spot cargoes on the East Coast. The general market rumor is that the distillate sold on the East Coast for less than the posted price on the Gulf Coast at the time of sale.

Quoted prices for kerosine and distillates on the Gulf Coast dropped soon after the middle of February. Kerosine is now available on that cargo market at 9.0 cents and No. 2 at 8.0 cents.

Most spot No. 2 on the Group 3 market is bringing 8.75 cents a gallon, but a few large distributors are rumored to be buying at 8.5 cents.

The higher Group 3 gasoline price seems to be holding. Most spot regular is moving at 10.25 cents a gallon.

Crude-Oil Prices

GRAVITY SCHEDULE

	Signal Hill, Calif.	Oklahoma	Gulf Coast Tex.*	West Tex.† N.M.	Wyo. (sour)
14-14.9	$1.76	....	....	....	....
15-15.9	1.84	....	....	....	$1.81
16-16.9	1.92	....	....	....	1.86
17-17.9	2.00	....	....	....	1.91
18-18.9	2.08	....	....	....	1.96
19-19.9	2.16	....	....	....	2.01
20-20.9	2.24	$2.49	....	$2.35	2.06
21-21.9	2.32	2.52	....	2.38	2.11
22-22.9	2.39	2.55	....	2.41	2.16
23-23.9	2.46	2.58	$3.44	2.44	2.21
24-24.9	2.53	2.61	3.46	2.47	2.26
25-25.9	2.60	2.64	3.48	2.50	2.31
26-26.9	2.67	2.67	3.50	2.53	2.36
27-27.9	2.74	2.70	3.52	2.56	2.49
28-28.9	2.81	2.73	3.54	2.59	2.54
29-29.9	2.87	2.76	3.56	2.62	2.59
30-30.9	2.93	2.79	....	2.65	2.63
31-31.9	3.00	2.82	....	2.68	2.67
32-32.9	3.06	2.85	....	2.71	2.71
33-33.9	3.12	2.88	....	2.74	2.75
34-34.9	3.17	2.91	....	2.77	2.79
35-35.9	3.22	2.94	....	2.80	2.83
36-36.9	3.27	2.97	....	2.83	2.87
37-37.9	3.31	2.99	....	2.86	2.89
38-38.9	....	3.01	....	2.89	2.91
39-39.9	....	3.03	....	2.92	2.93
40-40.9	....	3.05	....	2.95	2.95

*Low cold test crude. †Sour.

Effective dates of broad changes: California, 9-11-59; East of California, January 3-10, 1957; Pennsylvania Grade 1-11-60.

FLAT PRICES

Louisiana:	
Sweet Lake	$3.00
Texas:	
East Texas	3.05-3.25
Conroe	3.23-3.53
Van	3.08
Pennsylvania Grade:	
Bradford	4.55
Middle District	4.37
Southwest Pennsylvania	4.10
West Virginia	3.92
Buckeye Grade	3.77
Illinois Basin	**3.00**

FOREIGN

Canada:	
Leduc-Woodben	2.53
Redwater (Alta.)	2.42
Smiley (Sask.)	2.18
Pembina	2.38
Venezuela:	
Cumarebo, 48°-9°, Tucupido	3.34
San Joaquin, 41°-41.9°, Puerto La Cruz	3.08-3.10
Oficina, 35°-35.9°, Puerto La Cruz	2.80
Tia Juana medium, 26°-26.9°, Amuay*	2.30
Quiriquire, 16.0°-16.4°, Caripito	2.10
Lagunillas heavy, flat, Las Piedras*	2.10
Bachaquero, flat, 15°-16°, Las Piedras*	1.88

Prices for all crudes of 24° or lighter vary 2 cents per degree change, up or down. All crudes heavier than 24° vary 2.5 cents per half-degree gravity change.

*Also available at La Salina at 3 cents per barrel less.

Middle East, Persian Gulf (cargoes f.o.b. lifting port):	
Arabian, about 34°, Ras Tanura	$1.89
Iranian, 34.0°-34.9°, Bandar Masur	1.80
Iranian, 34.0°-34.9°, Abadan	1.81
Iraq, 36.0°-36.9°, Fao	1.82
Kuwait, 31.0°-31.9°, Mina-al-Ahmadi	1.67
Qatar, about 41°, Um Said	2.05
Middle East, E. Mediterranean:	
Arabian, about 35°, Sidon	2.29
Iraq, about 35°, Tripoli, Banias	2.29
Far East (cargoes, f.o.b. Lutong, Sarawak):	
Seria Light, 37°	2.57

Refined-Product Prices

Following quotations are for refinery products in cents per gallon moving in interstate shipments on Wednesday each week unless otherwise noted. Crude-oil prices are per barrel at the wells unless otherwise listed.

GASOLINE*

Mid-Continent (Group 3):	
Regular (91 octane)	10.25-10.50
Premium (99 octane)	12.75-13.25
Natural gasoline (26-70)	4.5
Breckenridge	4.0
Gulf Coast (cargoes for coastwise or export movements):	
Regular (90 octane)	10.25-10.50
Regular (92 octane)	10.50-10.75
Premium (98 octane)	11.75-12.00
California (rack) Los Angeles):	
Regular (88 octane)	11.65-12.15
Premium (94 octane)	12.65-13.15
Premium (100 octane)	14.00-14.65
Caribbean area (cargoes):	
Regular (87 octane)	10.125
Premium (97 octane)	11.75

*Quotations are for octanes shown. Prices usually vary with octane ratings within the regular, premium, and aviation grades.

KEROSINE AND DISTILLATE

Mid-Continent (Group 3):	
Kerosine 42-44	9.75-10.00
Diesel oil (58 d.i. and above)	9.50- 9.75
Distillate No. 1	9.50- 9.75
Distillate No. 2	8.75- 9.00
Gulf Coast (cargoes):	
★ Kerosine 41-43	9.00-9.50
★ Distillate No. 2	8.00-8.375
New York Harbor (barges):	
★ Kerosine 41-43	10.60-11.10
★ Distillate No. 2	9.60-10.10
★ Diesel fuel, 48-52 d.i.	9.90-10.40
Caribbean area (cargoes):	
★ Distillate No. 2	8.00-8.375

RESIDUAL FUEL (BBL.)

Mid-Continent (Group 3):	
★ Residual fuel (max. 1% S)	$1.70-1.80
Gulf Coast (cargoes):	
Bunker C fuel	$2.00
New York Harbor (barges):	
Bunker C fuel	$2.37
Caribbean (cargoes):	
Bunker C	$2.00
California (rack):	
Bunker C fuel, Los Angeles	$2.15

Tanker Rates (Long Ton)

(Latest reported spot fixtures)

Gulf-NY, clean (ATRS—21.25%)	$2.24
Gulf-NY, dirty (ATRS—21.25%)	2.24
Carib.-NY, dirty (ATRS—55%)	1.24
PG-UK, dirty (Scale—52.5%) (29s. 0d.)	4.06

★ Denotes change from previous week.

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FOR SALE EQUIPMENT

NEW Spencer-Harris portable rig, 2,000' to 6,000' with 3½ DP, complete, liberal discount. (Rig will go 7,000' with 3" N80 tubing and tool joints). R. M. Pair, 532 Chilton Tyler, Tex. Phone LY 4-4833.

PIPE CHAIN Tongs—Armstrong 15 and 35 for 2" to 12" pipe. Army surplus, unused in excellent condition. Price $29.50 each. Layne Northern Company, Inc., Mishawaka, Indiana.

CARDWELL MODEL K-200 double-drum unit powered by GZBU 145 Waukesha. 65 ft. telescopic poles with racking board. McKissick 2-sheave blocks, Mission deep well slips, elevators, and other tools included. Bought new and run one year. Call Joe Hodges Well Service, OVerland 3-2703, Bridgeport, Texas.

20 JANSEN 4S units complete with 1 H.P. 3-phase 440 V motors, sheves, starters, G. E. motor controls, time clocks, concrete bases etc. Big Lake Development, Paola, Kansas. AX 4-2746.

USED 170 H.P. D337 Caterpillar Diesel with 6,000 hours. Will sell reasonable. Contact Wayne E. Booker, R. R. #2, Calhan, Colorado.

LARGE QUANTITY good used eighteen inch pipe. Willing to sell below our cost price due to immediate removal. For further information call: Sam Miller, West Ohio Pipe Company, CA 6-0821, Lima, Ohio.

1075CFM, Ingersoll Rand, 6-XVO 13/13/9-1/4 x 12, with Intercooler Aftercooler, very good condition, 1943 machines, (3) available at a bargain price on East Coast.

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Box 1407 E. St. Louis, Ill.

Stops corrosion problems in refineries, oil fields, distribution equipment, filling station underground pipe installations, etc. Write for details. Free sample. GALV-WELD PRODUCTS, Dept. OGJ, P. O. Box 1303, Bradenton, Florida.

PIPE FOR SALE
15,000 ft., 5½" OD-15.5#, J55, Long Coupling
5,000 ft., 7" OD-20#, J55
10,000 ft., 2⅜" OD-4.7#, J55, EUE Tubing
Sucker rods, line pipe, tanks and pumping units.
All No. 1 Grade—Used
29,000 ft., 4½" OD-15.5#, S5, 30 ft. PE Tubing—New
Lundquist Pipe & Supply Co.
325 Wright Bldg., Tulsa, Okla., Phone LU 5-8850

—PIPE—

2,000,000 ft.	2"	3.50# to the ft.
1,000,000 ft.	3"	7.70#
1,000,000 ft.	4"	10.98#
500,000 ft.	6"	19.80#
200,000 ft.	8 5/8"	28#
400,000 ft.	10¾"	35#
75,000 ft.	12¾"	40#
10,000 ft.	16"	42#

All No. I Grade plain end and cleaned.

INDIANA-OHIO PIPE CO.
P. O. Box 5412 Shep. Sta.
Columbus 19, Ohio
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FOR SALE EQUIPMENT

18" AND 20" good used pipe. Very attractive prices. Contact: The Tri-State Pipe Co., Bellaire, Ohio. Telephone OR 6-1452.

USED EXCELLENT CONDITION: 1—503 American pumping unit 173,000"#, 54" max. stroke, 25,000# structure. 1—T9D40 Bethlehem unit 40,000"#, 32" max. stroke W/7½ HP 1,200 RPM 220/440 V motor and control. 3—ZC118 F-M engines W/clutch and sheave. Buckeye Supply Co., El Dorado, Kansas. Phone DA 1-1060.

1—ALDRICH 3½" x 7" Triplex salt water pump, with Lufkin gear reducer and 100 HP electric motor. Capacity 6,000 bbl. per day, 820 lbs. pressure. Price $3,500.00. Woodford Supply Company, P. O. Box 84, Phone CE 5-1454, Oklahoma City 1.

NATIONAL "50" Rotary rig. Complete with 96' Lee C. Moore mast, 2 Waukesha "NK" motors, 7¼ x 14 Wheland pump, 6,000' of 4½" drill pipe. Cash, or will trade for production or producing equipment. L. B. Jackson Company, Box 717, Sapulpa, Oklahoma.

PIPE SHOP BUILDING—Overhead tracks and hoists. Landis pipe machine, 2" through 8", 2 heads. Bignall & Kehler machine 8" through 20" with all dies. Excellent condition. Will make good deal. The Yard, 725 E. Central, Wichita, Kansas. Phone AMherst 5-4672.

36" x 70' Overall LEBLOND COMBINATION OILFIELD TURNING THREADING BORING & TREPANNING LATHE.
(Can be used as a 25' CC Lathe). NEW 1941. Used by gov. 1 yr. 16" hole in spdle. Boring bar 25'. Terms. 90 day return guarantee.
20MB & 27MB SMALLEY GENERAL AUTOMATIC CHUCKING THREAD MILLING MACHINES. Used 1 yr. IN LIKE NEW CONDITION.
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COMPRESSORS, Clark Gas RA-5; Clark Cent. 7,860 CFM 2 Stage
CONDENSERS 7,500 to 100 sq. ft.
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HEATER TUBES Chrome 4" to 6" O.D.

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2 COMPLETE UNIT rigs for sale U-15 drawworks. 1 rig is powered by 3 NKU Waukesha engines. 1 rig powered by 2 LRO Waukesha engines. Drill pipe and collars optional. Rigs may be seen at Henson Drilling Company yard in Abilene, Texas. Complete inventory on request.

FOR SALE OR LEASE: Three (3) large perforating trucks complete with 16,000' of 7/16" single conductor line. These units are ready for the field. Box L-614, The Oil and Gas Journal, Tulsa, Oklahoma.

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BOILERS, 5—70,000 #/hr. 450 Psi.
HORTONSPHERES, 6—5,000 & 10,000 bbl.
EXCHANGERS, 78 to 4,000 sq. ft.
TOWERS, 3 ft. to 12 ft. diameter.
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FURNACES, 15 MM & 34 MM BTU/hr.

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CENT. COMPRESSORS, 38,000, 9,370 & 5,535 CFM.
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TURBINES, 5 to 1,400 HP.
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1—36-L BUCYRUS ERIE spudder, trailer mounted, less tools. Price $7,000.00. Woodford Supply Company, P. O. Box 84, Phone CE 5-1454, Oklahoma City 1.

FOR SALE—1 National T-32 Drilling Rig, complete, excellent condition Twin Disc Torque Converter, powered by Twin 6-71 GM Diesels, 127 ft. Lee C. Moore Mast, Substructure, C-250 Ideal Mud Pump, powered by Twin 6-71 GM Diesels, 5,100 ft. good 4½" drill pipe, 5 collars 5¾". Located in Kansas. Bachus Oil Company, 721 East Central, Wichita 2, Kansas. Phone AMherst 5-9531.

1 HYDRAULIC CASING pulling machine, complete. Price $6,500. Sell or trade. Woodford Supply Company, P. O. Box 84, Phone CE-51454, Oklahoma City 1.

1 BUCYRUS—ERIE 36L Spudder, late model. Rig complete with tools and equipment. Cassel Drilling Co., Inc., Dumas, Texas. Phone WE 5-5019 or WE 5-4369.

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PETROLEUM GEOLOGIST—married, age 28, B.S. degree, with four years experience in South America in operation and exploration phases of geology, plus training in petroleum engineering desires position in the U.S. preferably in the Permian Basin. Box L-720, The Oil and Gas Journal, Tulsa, Oklahoma.

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U. S. DEPARTMENT OF THE INTERIOR, Bureau of Land Management, Denver, Colorado. Notice is hereby given that 177.98 acres of land in two parcels within the known geologic structure of Temple Canyon Field, Moffat County, Colorado, will be offered for oil and gas leasing through competitive bidding to the qualified bidder of the highest cash amount per acre, at 2 p.m., M.S.T., May 6, 1960, when bids will be opened. Details of the lease offering, how and where to submit bids, and forms, may be obtained from the Bureau's Land Office, P. O. Box 1018, Denver, Colorado. Dale R. Andrus, Land Office Manager.

LEGAL

U. S. DEPARTMENT OF THE INTERIOR, Bureau of Land Management, Denver, Colorado. Notice is hereby given that 107.99 acres of land in two parcels within the known geologic structure of McCallum Field, Jackson County, Colorado, will be offered for oil and gas leasing through competitive bidding to the qualified bidder of the highest cash amount per acre, at 2 p.m., M.S.T., April 22, 1960, when bids will be opened. Details of the lease offering, how and where to submit bids, and forms, may be obtained from the Bureau's Land Office, P. O. Box 1018, Denver, Colorado. Dale R. Andrus, Land Office Manager.

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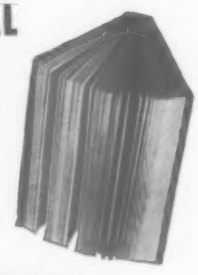

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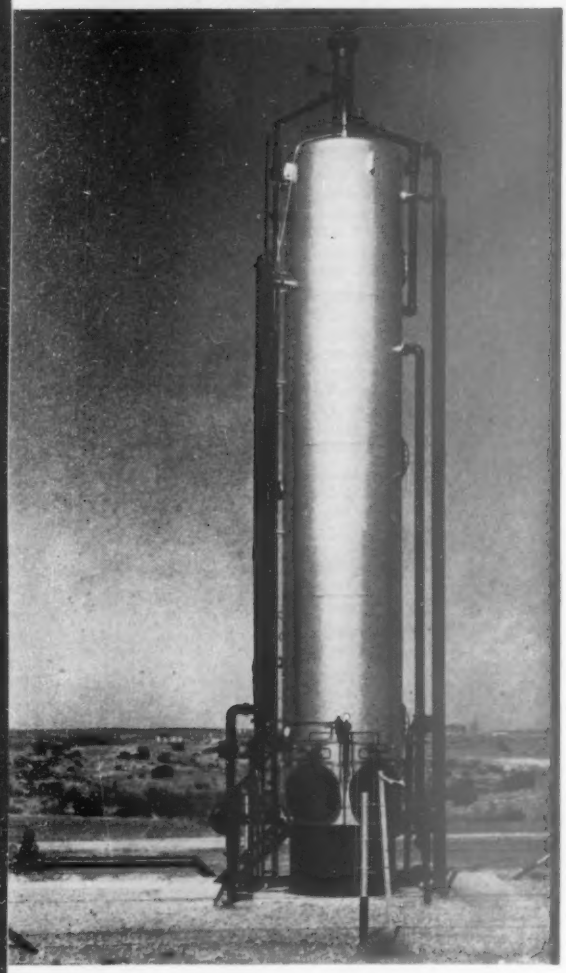

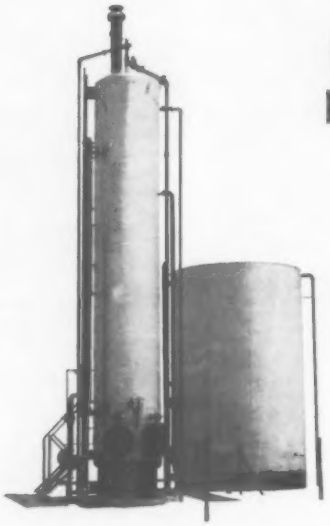

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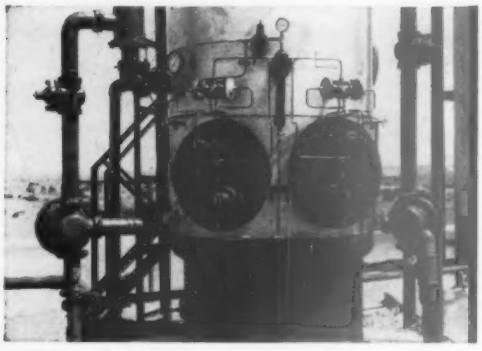

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